

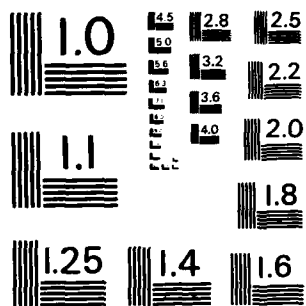
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THE SOLAR SPECTRUM 3089A-2095A FROM THE ECHELLE
SPECTROGRAPH FLOWN IN 196..(U) NAVAL RESEARCH LAB
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20. ABSTRACT (Continued)

study of the multiplets in individual spectra and are based on a search of the spectroscopic literature. Laboratory wavelengths, multiplet numbers, and references are cited for each line. Approximately 6150 lines are reported, of which 80% are identified.

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The Solar Spectrum 3069Å-2095Å

**From the Echelle Spectrograph
Flown in 1961 and 1964**

**An Extension
of
Rowland's Preliminary Table
of
Solar Spectrum Wavelengths**

CHARLOTTE E. MOORE

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**E. O. Hulburt Center for Space Research
June 1982**

**Naval Research Laboratory
Washington, D.C.**

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PART I

INTRODUCTION

Historical Background

The first solar spectrum in the ultraviolet range that is inaccessible from the ground was obtained on October 10, 1946 by the Naval Research Laboratory (NRL) (Baum et al. 1946). Although the resolution was only 3\AA , this was sufficient to reveal many great absorption features: Si I 2882 \AA ; Mg I 2852 \AA ; Mg II 2803 \AA and 2796 \AA , the analogs of the H and K lines of Ca II; and numerous strong multiplets of Fe I and Fe II. During the next fifteen years there followed many observations of the solar spectrum from rockets, making use of far more powerful equipment. Within the range 3000 \AA to 2100 \AA , where the spectrum is almost exclusively one of Fraunhofer lines, an increase in spectral resolution by about one order of magnitude was achieved. Spectra having 0.5\AA resolution were obtained by both the Naval Research Laboratory and the University of Colorado. In the U.S.S.R. during 1956 and 1960 a group from the Institute of Optics in Leningrad flew a 1-meter grating spectrograph equipped with a solar pointing control (Jakovleva and Vedeshin 1978). With this instrument, spectra having 0.3\AA resolution from 2937 \AA to 2471 \AA were obtained on May 31, 1956; and in 1959, by using the same instrument in second order, a resolution of 0.15\AA was secured in the range 3100 \AA to 2700 \AA .

For the period through 1962, solar ultraviolet research from rockets has been described in detail by Tousey (1963). From these early flights came a series of publications best described as ultraviolet extensions of Rowland's Preliminary Table of Solar Spectrum Wavelengths (1895 to 1897) and of the Revision of Rowland's Preliminary Table by St. John et al. (1928). Mainly of historical importance are the first ultraviolet solar line lists of NRL (Durand, Oberly and Tousey 1949) and of the Applied Physics Laboratory of The Johns Hopkins University (Hopfield and Clearman 1948). The principal lists are the following: the spectra of NRL, from 2990 \AA to 2635 \AA by Wilson et al. (1954), and from 2635 \AA to 2085 \AA by Malitson et al. (1960); the spectra of the University of Colorado from 2965 \AA to 1800 \AA (Behring et al. 1958, McAllister 1960); and the spectra of the U.S.S.R. from 3100 \AA to 2635 \AA by Kachalov and Jakovleva (1962), and from 2635 \AA to 2471 \AA as a line list by Kachalov et al. (1958). Each of these publications except the last took the form of an atlas with the curve of spectral distribution plotted on a scale of absolute energy. The spectral resolution was in the range 0.15\AA to 1\AA . In the publications of NRL and of the University of

Colorado, the identifications of the lines were entered on the actual atlas curves. The identifications of the U.S.S.R. investigators were presented in the form of lists.

From the results of this first decade, it was already clear that an increase in spectral resolution by another order of magnitude would be necessary to resolve adequately the Fraunhofer lines in the ultraviolet solar spectrum. To achieve this required a spectrograph of small size and weight, yet capable of high spectral resolution. The timely development of the echelle diffraction grating by Harrison (1949), and of replication techniques by Bausch & Lomb, Inc. (Loewen 1972) under the direction of David Richardson, came at just the right time to make this possible.

In this report we present in final form a listing of the Fraunhofer lines as recorded by the NRL echelle spectrograph on the flights of 1961 and 1964. All plausible identifications have been made. In spite of much study many lines could not be identified, and so they will remain, awaiting further research in the laboratory.

For the first thirty years of space research, it was only the sun whose ultraviolet spectrum could be recorded with resolution sufficient to resolve satisfactorily the Fraunhofer lines. With the successful placing in orbit of an echelle spectrograph designed to study the stars (IUE 1978), there is available now a wealth of ultraviolet spectra of nonsolar objects. For the interpretation of these remarkable new spectra, this solar ledger will be of value.

The Echelle Spectrograph

Design of the NRL echelle spectrograph was commenced in 1952 by R. Tousey and F. S. Johnson. The instrument was completed by J. D. Purcell and flown on September 17, 1957. The peak altitude reached did not place the spectrograph above the entire ozone layer. Nevertheless the solar spectrum was photographed to 2600 \AA with a resolution of 0.1\AA , and the potential of the instrument was proved (Purcell, Boggess and Tousey 1958).

The second flight, August 29, 1961, was a complete success. The spectrum was recorded to 2200 \AA with a resolution of 0.03\AA , which was the best that was expected. In a third flight on November 21, 1964 the spectrum reached almost 2085 \AA , the end of the range typical of the photosphere; the resolution was 0.05\AA . The instrument and the spectra have been described in detail by Tousey, Purcell and Garrett (1967).

In order that the spectrograph be as compact as possible, it was constructed in the Littrow form with the echelle grating taking the place of the Littrow mirror. The echelle was of 73.25 grooves per mm, 2:1 ratio of groove width to groove height, and $63^\circ 26'$ blaze angle. The lens that provided both collimation and focusing was a triplet of 400 mm focal length with outer elements of lithium fluoride and central element of crystal quartz. Although the system was achromatized as completely as possible, there was a great deal of residual longitudinal chromatic aberration, which was corrected by pulling the film against a template of the proper shape. Separation of the many high-order spectra from the echelle was accomplished by cross-dispersion produced by a prism of calcium fluoride introduced between the lens and the echelle.

Because the intensity of the solar spectrum at $\lambda > 4000\text{\AA}$ is great by comparison with the rapidly decreasing intensity shortward of 3000\AA , it was necessary to minimize the radiation scattered by the echelle and the associated optical system. This was accomplished by means of a small, zero-dispersion double-monochromator constructed with Féry prisms of quartz. This predisperser was placed directly before the slit. The entire instrument was kept pointed at the sun with a solar pointing control that corrected for the yaw and pitch of the rocket.

Although the predisperser was adjusted to reject the entire solar spectrum at $\lambda > 3300\text{\AA}$, the residual scattered light was not negligible and set a limit on the shortest wavelengths that could be photographed. On the 1961 flight the spectrum reached 2200\AA before it became swamped with stray light. For the 1964 flight the predisperser was readjusted to reject all radiation of $\lambda > 2500\text{\AA}$. As a result, the stray light was reduced and the spectrum extended nearly to 2085\AA .

A second effect of the scattered light was to fill in somewhat the bottoms of the strongest Fraunhofer lines. Contributing to this was another type of stray light produced by ghosts present in the echelle images. To evaluate this "nearby" stray light, the spectrum of a source containing narrow emission lines was photographed in the laboratory. The profile of Fe II 2739.545\AA from line-center to 10% of peak was found to be approximately Gaussian with a full width at half maximum (FWHM) of 0.03\AA . Farther from line-center it broadened faster than Gaussian and beyond 0.1\AA from line center the intensity remained at about 1% of peak. It is difficult to evaluate precisely the magnitude of these effects. Although the stray light increased in intensity with decreasing wavelength, the increase was not sufficiently rapid to affect relative intensities within multiplets. It is not certain that any faint lines were obliterated by scattered light except at the short-wavelength end of the spectrum.

The optical characteristics of the system were such that radiation was accepted from the sun's center to about $1/3 R$. Therefore, the echelle spectra should be regarded as disc spectra with no significant contribution from regions near the limb.

The Echelle Spectra

The solar spectrum photographed by the echelle spectrograph on the flight of 1961 is reproduced in Fig. 1. In actual size the frame measured $25\text{mm} \times 25\text{mm}$. To record photographically the entire spectral range required exposures of several different times, and Fig. 1 is a composite. The dispersion on the film runs linearly with order number, shown at the left, from $2.5\text{\AA}/\text{mm}$ near 4000\AA to $1.25\text{\AA}/\text{mm}$ at 2000\AA . For wavelengths greater than 3069\AA the spectrum was not studied because this region is well known from the ground-based observations (Moore, Minnaert, Houtgast 1966).

For the shortest wavelengths the most useful spectra were obtained from the flight of 1964, as shown in Fig. 2. Although the spectra extend to 2085\AA , approximately, the lines reported here are limited to $\lambda > 2095\text{\AA}$. Below 2085\AA the continuum intensity falls by a factor of 4 or 5 within 15\AA . Therefore, shortward of 2085\AA the Fraunhofer lines are almost vanishingly faint and little of value was present in the spectra below 2095\AA .

The spectral resolution in the 1961 spectra was 0.03\AA . This was consistent with the 0.03\AA FWHM of Fe II 2739.545\AA , determined in the laboratory before flight. In the 1964 spectra the resolution was 0.05\AA , owing to a slight deterioration of adjustment during flight. Twelve exposures were made during each flight, of times between 2 s and nearly 100 s.

The Preliminary Solar Ledger

Analysis of the echelle spectra was commenced soon after the 1961 flight. The first task was to establish a wavelength scale. This could not be done with sufficient precision simply by using the grating equation because of the great distortion introduced by the several refractive elements in the optical system. It was necessary also to establish a separate wavelength scale for each order. This was done empirically by comparison with exposures made with a low-pressure, RF-excited iron arc which produced a rich, narrow-line spectrum of Fe I and Fe II. The iron lines were used as internal standards for the generation of the dispersion curve for each order. The dispersion equation was set up as a third order polynomial with coefficients adjusted by computer until the residuals were minimal and random. With the aid of these dispersion equations the wavelengths of the solar lines were derived for each order from their measured positions.

The first solar ledger was prepared from the 1961 spectra by L. E. Giddings. The list extended from 3069\AA in order 80 to 2288\AA in order 106. By making use of the 1964 spectra, the list was carried to 2095\AA in order 116. The complete list contained 7146 lines. The lines in this preliminary ledger were identified as to chemical origin by P. A. Simmons. The identifications

were based mostly on the Multiplet Tables (UV and MT in the references). Identifications were proposed for about half of the observed solar lines. Although considered preliminary, copies of the ledger were distributed on request.

The NRL Solar Atlas: 2226Å to 2992Å

The preparation of an atlas that would contain curves of spectral irradiance at one AU in absolute units of energy and at full spectral resolution was commenced soon after the 1961 flight. The best spectra were scanned with a microphotometer and the values of density were converted to relative intensities by means of photographic characteristic curves. Finally, the relative values of intensity were converted to absolute values of irradiance in $\mu\text{Wcm}^{-2}\text{\AA}^{-1}$. This was done by adjustment of the relative

intensity curves to the curves of absolute intensity at 2.5Å spectral resolution of Wilson et al. (1954) and Maltson et al. (1960). The adjustment was carried out at 142 wavelength positions scattered over the entire range. The curves of lower resolution had been calibrated by comparison with data from an instrument designed primarily for the measurement of the absolute spectral solar flux. This procedure was complex and is described in detail in the NRL Atlas (Tousey et al. 1974).

The wavelength scale for the Atlas was derived from the Preliminary Ledger, which was nearing completion well before the Atlas was completed. The short-wavelength end of the Atlas coincided with the end of the echelle spectrum of 1961. The long-wavelength end was set somewhat arbitrarily by the end of order number 80, and because the Atlas being produced from observations at the Jungfraujoch Observatory was expected to extend to 3000Å (Delbouille, Neven and Roland 1963, 1973).

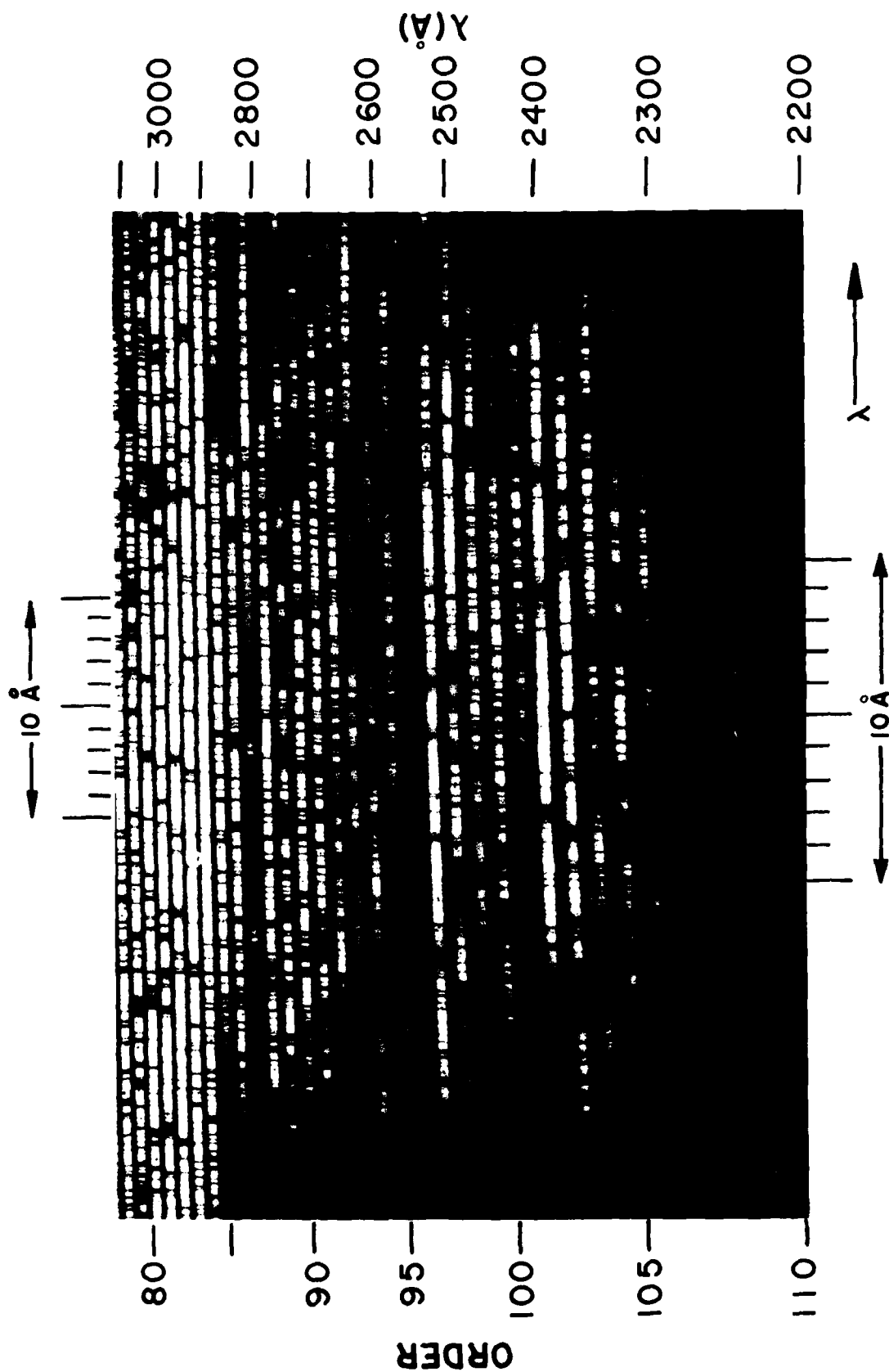


Fig 1 — The Ultraviolet Solar Spectrum recorded on August 29, 1961 with the NRI Echelle Spectrograph

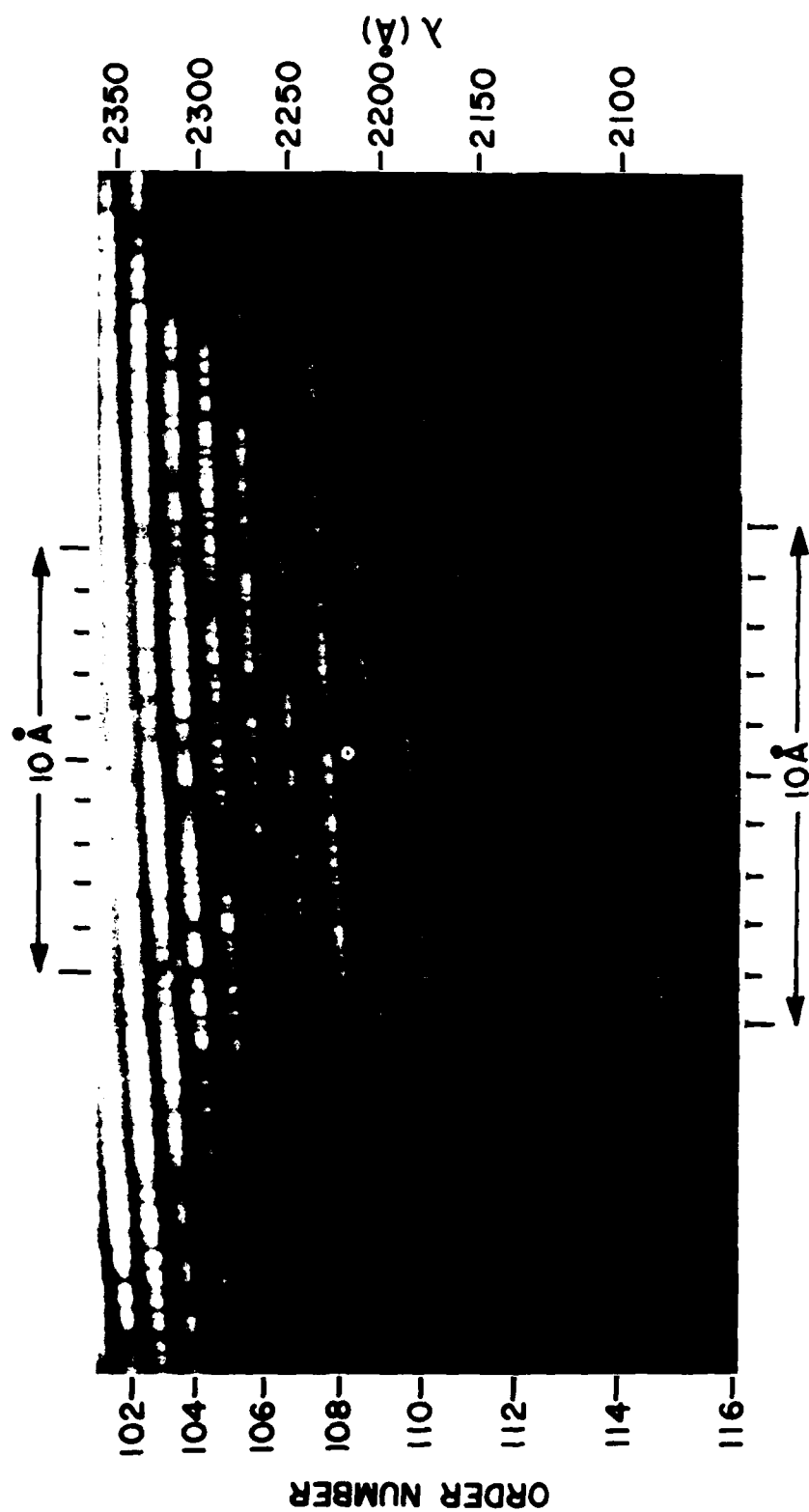


Fig. 2 — The shortest wavelengths in the solar spectrum recorded on November 12, 1964 with the NRL Echelle Spectrograph

PART II

THE FINAL SOLAR LEDGER

Procedure

In preparing the Final Solar Ledger the Preliminary Ledger has been extensively revised. The wavelength and intensity of each solar line were reconsidered. New lines were added and doubtful lines were deleted. The identifications were restudied in detail, taking into account laboratory wavelengths published or available through mid-1981. The complete multiplet structure was examined for each multiplet believed to be present or expected. Lines of individual spectra were identified on the basis of the behaviour of their ultimate lines including those outside the NRL echelle range.

The reexamination of the spectra involved a study of the same set of prints that formed the basis for the preliminary list. One print was available for each order, taken from the exposure of most suitable density. These prints were enlarged to a dispersion of about 1 Ångstrom per inch; therefore, all lines could be studied easily without using a magnifier. Also taken into consideration was the Atlas, which was not available when the preliminary list was compiled. The Atlas often served to disentangle features that were not clearly interpretable from the prints.

The Final Solar Ledger is based on the NRL echelle spectra only. Other spectra obtained since 1964 are discussed in Part IV. The spectroscopic material used for identification includes the Multiplet Tables of Moore (1945-1981), supplemented by data published after completion of the various Multiplet Tables and by unpublished work available to mid-1981. Predicted wavelengths have been used where laboratory measurements are missing for members of multiplets expected to be present in the solar spectrum.

The preparation of the Final Solar Ledger from the Preliminary Ledger proceeded as follows. First, the identifications were examined in detail as described above, by element and ion from the lightest atom through the heaviest that might possibly be encountered. From all available material, the best laboratory wavelength was chosen for each line and a judgment was made of its value for use as an internal standard of wavelength. Then, by reexamining the prints, the reality of each line was verified and its wavelength was checked by interpolation between the various nearby lines that appeared to be suitable as standards. At the same time

visual intensities were reexamined and compared with the intensities expected from laboratory data, and also with the intensities in the Atlas. It was always necessary to consider blending and masking and to estimate the expected intensities of contributors by consideration of the intensities of related well-identified unblended lines.

The result of this iterative process is the Final Ledger that forms the main body of this publication. In character this final solar line list is conservative; many lines in the preliminary list have been omitted, a smaller number have been added.

The Solar Wavelengths

In column 1 of the Solar Ledger the wavelengths in air and in Ångstrom units are listed for all features present in the echelle spectra. All entries refer to ordinary, unblended lines of width consistent with the instrumental profile, 0.03 Å FWHM, unless accompanied by a brace. A brace in Column 1 indicates a pair or group of lines between the tabulated wavelength-limits that are not completely resolved but for which it was possible to assign separate wavelengths and intensities. A brace in the intensity column indicates that two or more lines are present but not well-resolved, and that a single intensity has been given to the entire feature.

The process of determining wavelengths was one of continual adjustment and fitting. Beginning at one end of an order, a print was examined and the identified lines were noted together with their laboratory wavelengths and intensities. Although the dispersion was not constant along an order, within intervals of one or two Ångstroms it was sufficiently constant to permit making a linear interpolation. For each short interval a linear scale was constructed, based on solar lines believed to be unblended and satisfactory for use as internal standards. Wavelengths of unidentified lines were read from these scales. Wavelengths of identified lines not used as internal standards were also checked. Inevitably, the wavelengths of some such lines were not in acceptable agreement with the laboratory values. In each such case a decision was made as to whether the line was incorrectly identified or whether it was a blend.

All solar wavelengths are given to two decimal places even though it has been stated in earlier publications that the accuracy is better than 0.01 Å. In general,

the probable error of each solar wavelength is considered to be about $\pm 0.005\text{\AA}$. In selected regions three-place entries may be justified for lines of good quality that show no effects of blending, provided that there are satisfactory lines nearby for use as standards. At the short-wavelength end the error is larger, and at 2095\AA the Ledger was terminated.

The Solar Intensities

The estimated intensities of the solar lines are given in column 2 on a scale that was strictly visual. The scale was arbitrary, from 1 for the faintest lines to 9 for the strongest. Features that were too broad to be single, narrow lines were indicated by the following symbols in Column 2, which are descriptive of the character of the line:

<i>D</i>	wide and double (unresolved pair)
<i>d</i>	double
<i>H</i>	very hazy
<i>h</i>	hazy
<i>W</i>	very wide
<i>w</i>	wide

Values of visual intensity were assigned to lines by studying the appearance of images on the large prints. A comparison was also made with the intensity tracings in the Atlas, taking particular note of the depths of the lines. In this way it was possible to set up a range of central intensity for each value of visual intensity. This process of comparison was particularly helpful for assigning meaningful visual intensities at the ends of orders where the contrast was less, and for making certain that the scale of visual intensities carried over from order to order.

Visual intensities have their greatest significance, of course, over short ranges of the spectrum, and lose meaning rapidly the greater the wavelength difference between the lines being compared. This is especially true of the echelle spectrum, whose character changes greatly as the short wavelength end is approached. Over the wavelength-range of most multiplets, however, the visual intensities assigned to the solar lines can be compared directly with the relative intensities reported for laboratory spectra.

Broad, strong lines with extended wings presented two difficulties when assigning visual intensities. The prime examples of such lines are $\text{Mg II } 2796\text{\AA}$ and 2803\AA , each of which dominates the spectrum over some 30\AA , and $\text{Mg I } 2852\text{\AA}$ which spans more than 15\AA . To a lesser degree the same is true of the leading lines of Fe I , Fe II , Ni I , Mn II and Si I . The first difficulty was in the assignment of a visual intensity that would take into account both the central depth and the width for a very broad, intense line. Arbitrarily, intensities 8 and 9 were restricted to lines that are wide as well as deep. For the

Mg lines noted above, however, a meaningful assignment of intensity could not be made.

The second difficulty related to the obscuring effect of a very wide line on other lines that lie within the span of its wings. Rather than base the visual intensity strictly on conspicuousness for a line lying within a broad wing, an allowance was made for the effect of the wing on its apparent strength. This was an imprecise procedure at best, and it is probable that the intensities were underestimated for lines lying in the deepest parts of strong, wide lines.

A list of lines judged to be "winged" is presented in Table 1. They were selected by examining systematically their profiles as shown in the Atlas. The criterion for inclusion was appearance, independent of origin or multiplet structure. Columns 1 to 4, wavelength, intensity, identification, and multiplet number, were taken from the Ledger. The fifth column lists the low excitation potential as given in the multiplet tables. The last column gives the effective span of the wings in λ , and $\Delta\lambda$. This span, estimated arbitrarily to an accuracy of about 0.1\AA , although far from well-defined, serves as a guide to the possible masking effect of the wings. Of the 90 winged lines listed in Table 1, 76 are single lines, 12 are blends of two lines, and 2 are blends of three lines, for a total of 106 lines. Most of these lines are of intensity 6 or greater and in the Ledger are described as "W", as would be expected.

The Identification of the Solar Lines

The spectra identified as accounting for the observed solar lines are entered in the Final Solar Ledger as columns 3 to 6: atomic or ionic spectrum; multiplet number; laboratory wavelength, accompanied by the symbol \pm in the case of a raie ultime; and reference, respectively. Two molecular spectra are included: OH, known to be present and strong at longer wavelengths; and SiO, which is identified here for the first time. Where the solar feature is produced by more than one line the contributors are entered in order of increasing wavelength.

The symbols in column 3 have the following meanings:

- following the identification denotes that the laboratory line is to the violet of the solar line, and vice versa for the dash preceding.
- || preceding the identification indicates a pre-dominant contributor, which almost but not completely masks all other contributors.
- | preceding the identification denotes a principal contributor which is only moderately the strongest contributor to a blend.

Table I — Winged Lines in the Echelle Solar Spectrum

Solar Wavelength Å	Intensity	Identification	Multiplet No.	Low E P	Span of Wings Å	
					λ	$\Delta\lambda$
2310.96	8W	Ni I	10	0.00	2310.6 - 2311.3	0.7
2312.34	7W	Ni I	10	0.16	2312.2 - 2312.5	0.3
2317.16	7W	Ni I	8	0.16	2317.0 - 2317.3	0.3
2320.04*	8W	Ni I	9	0.00	2319.8 - 2320.2	0.4
2325.80	7W	Ni I	9	0.16	2325.7 - 2326.0	0.3
2327.41	7W	Fe II	3	0.08	2327.1 - 2327.7	0.6
2329.96	7W	Ni I	8	0.27	2329.8 - 2330.1	0.3
2331.30	7W	Fe II	35	0.23	2331.1 - 2331.6	0.5
2332.82	9W	Fe II	3	0.05	2332.3 - 2333.3	1.0
2338.00	9W	Fe II	3	0.11	2337.0 - 2339.0	2.0
2343.50	9W	Fe II	3	0.00	2342.5 - 2344.5	2.0
2348.13	7W	Fe II	36	0.23	2347.8 - 2348.5	0.7
2348.31	8W	Fe II	3	0.08		
2354.88	6W	Fe II	35	0.35	2354.8 - 2355.1	0.3
2359.10	8W	Fe II	3	0.11	2358.8 - 2360.6	1.8
2360.01	7W	Fe II	35	0.23		
2360.29	7W	Fe II	36	0.30	2364.4 - 2365.2	0.8
2364.84	8W	Fe II	3	0.05		
2368.60	7W	Fe II	36	0.35	2368.3 - 2368.9	0.6
2373.75	8W	Fe II	2	0.00	2373.4 - 2374.0	0.6
2375.20*	7W	Fe II	36	0.38	2375.0 - 2375.4	0.4
2379.28	7W	Fe II	36	0.30	2379.1 - 2379.5	0.4
2380.76	8W	Fe II	3	0.08	2380.6 - 2381.1	0.5
2382.03	9W	Fe II	2	0.00	2381.2 - 2384.0	2.8
2388.65	8W	Fe II	2	0.05	2388.1 - 2389.2	1.1
2395.62	9W	Fe II	2	0.05	2394.5 - 2396.5	2.0
2399.25*	8W	Fe II	2	0.08	2398.9 - 2399.6	0.7
2404.93	9W	Fe II	2	0.08	2404.0 - 2405.5	1.5
2406.66	8W	Fe II	2	0.11	2406.4 - 2406.9	0.5
2410.55	8W	Fe II	2	0.11		
2411.08	8W	Fe II	2	0.12	2410.2 - 2411.4	1.2
2413.31	8W	Fe II	2	0.12		
2435.15	7W	Si I	45	0.78	2434.9 - 2435.5	0.6
2462.65	8W	Fe I	9	0.00	2462.5 - 2462.8	0.3
2472.91*	8W	Fe I	9	0.05	2472.7 - 2473.1	0.4
2479.77	7W	Fe I	9	0.09	2479.5 - 2480.1	0.6
2483.28	8W	Fe I	9	0.00	2482.9 - 2483.7	0.8
2488.14	8W	Fe I	9	0.05	2487.7 - 2488.5	0.8
2490.65	7W	Fe I	9	0.09	2490.4 - 2491.5	1.1
2491.15	6W	Fe I	9	0.11		
2501.13	7W	Fe I	7	0.00	2500.8 - 2501.5	0.7
2506.91	8W	Si I	1	0.01	2506.7 - 2507.1	0.4
2510.84	7W	Fe I	7	0.05	2510.6 - 2511.1	0.5
2514.31	8W	Si I	1	0.00	2514.2 - 2514.6	0.4
2516.10	9W	Si I	1	0.03	2515.6 - 2516.6	1.0
2519.20	8W	Si I	1	0.01	2519.0 - 2519.3	0.3
2522.85	8W	Fe I	7	0.00	2522.6 - 2523.0	0.4
2524.11	7W	Si I	1	0.01	2523.8 - 2524.4	0.6
2524.28	6W	Fe I	7	0.11		
2527.43	7W	Fe I	7	0.05	2527.2 - 2527.6	0.4
2528.51	7W	Si I	1	0.03	2528.3 - 2528.7	0.4
2540.97	6W	Fe I	7	0.11	2540.6 - 2541.4	0.8
2545.97	6W	Fe I	7	0.09	2545.7 - 2546.4	0.7

Table 1 — Winged Lines in the Echelle Solar Spectrum — Continued

Solar Wavelength Å	Intensity	Identification	Multiplet No.	Low E P	Span of Wings Å	
					λ	$\Delta\lambda$
2549.61	6W	Fe I	7	0.05	2549.4 - 2549.8	0.4
2562.54	7W	Fe II	64	0.98	2562.2 - 2562.8	0.6
2563.49	6W	Fe II	64	1.04	2563.2 - 2563.7	0.5
2566.91	6W	Fe II	64	1.07	2566.7 - 2567.1	0.4
2576.12	8W	Mn II	1	0.00	2575.7 - 2576.5	0.8
2577.91*	7W	Fe II	64	1.09	2577.8 - 2578.1	0.3
2582.58	6W	Fe II	64	1.07	2582.3 - 2582.9	0.6
2585.90*	9W	Fe II	1	0.00	2584.8 - 2587.0	2.2
2593.72*	7W	Mn II	1	0.00	2593.1 - 2594.3	1.2
2598.37	9W	Fe II	1	0.05	2596.9 - 2601.9	5.0
2599.40	9W	Fe II	1	0.00		
2605.67*	6W	Mn II	1	0.00	2605.4 - 2605.9	0.5
2607.09	9W	Fe II	1	0.08	2606.3 - 2607.9	1.6
2611.89	9W	Fe II	1	0.05	2611.2 - 2612.6	1.4
2613.85	8W	Fe II	1	0.11	2613.2 - 2614.4	1.2
2617.63	8W	Fe II	1	0.08	2616.9 - 2618.3	1.4
2621.68	8W	Fe II	1	0.12	2621.3 - 2622.1	0.8
2625.68	8W	Fe II	1	0.05	2624.9 - 2626.3	1.4
2628.30	8W	Fe II	1	0.12	2627.8 - 2628.8	1.0
2631.04	8W	Fe II	1	0.11	2630.2 - 2632.1	1.9
2631.33	8W	Fe II	1	0.08		
2714.42	7W	Fe II	63	0.98	2714.1 - 2714.7	0.6
2719.04	8W	Fe I	5	0.00	2718.2 - 2721.5	3.3
2720.90	7W	Fe I	5	0.05		
2723.58	6W	Fe I	5	0.09	2723.3 - 2723.9	0.6
2727.55	7W	Fe II	63	1.04	2727.2 - 2727.9	0.7
2736.97	6W	Fe II	63	1.07	2736.4 - 2737.7	1.3
2737.30	6W	Fe I	5	0.11		
2739.56	8W	Fe II	63	0.98	2738.8 - 2740.4	1.6
2742.40	6W	Fe I	5	0.09	2742.1 - 2742.7	0.6
2743.20	7W	Fe II	62	1.09	2743.0 - 2743.4	0.4
2746.49	7W	Fe II	62	1.07	2745.8 - 2747.2	1.4
2746.98	7W	Fe II	63	1.04		
2749.18	7W	Fe II	63	1.07	2748.7 - 2749.8	1.1
2749.32	7W	Fe II	62	1.04		
2749.48	6W	Fe II	63	1.09		
2755.74	8W	Fe II	62	0.98	2755.3 - 2756.2	0.9
2779.84	7W	Mg I	6	2.70	2779.6 - 2780.1	0.5
		Mg I	6	2.70		
2788.11	7W	Fe I	44	0.86	2787.8 - 2788.4	0.6
2795.53	—	Mg II	1	0.00		> 30
2802.70	—	Mg II	1	0.00		> 30
2852.13	—	Mg I	1	0.00		> 15
2881.58	8W	Si I	43	0.78	2880.3 - 2882.9	2.6
2912.15	7W	Fe I	1	0.00	2912.0 - 2912.3	0.3
2936.51	7W	Mg II	2	4.41	2936.3 - 2937.2	0.9
2936.91	8W	Fe I	1	0.00		
2947.89	8W	Fe I	1	0.05	2947.3 - 2948.3	1.0
2953.93	8W	Fe I	1	0.09	2953.5 - 2954.3	0.8
2966.91	9W	Fe I	1	0.00	2966.4 - 2967.4	1.0
2973.13	7W	Fe I	1	0.09	2972.8 - 2973.6	0.8
2973.23	8W	Fe I	1	0.05		
2983.59	8W	Fe I	[9]	0.00	2983.3 - 2983.9	0.6

*Entered in Ledger as a blend, but in the study of the winged lines the predominant contributor was considered as unblended

For example,

2166.19	5D	Ni I— Fe II
2165.55	6d	Ni II Fe II

The solar intensity to be expected, as judged by the intensities of other lines in a multiplet, has been the guiding factor in deciding the question of principal vs. predominant contributor.

Multiplet numbers (column 4) are taken from three sources:

The Ultraviolet Multiplet Table
The Multiplet Table of Astrophysical Interest
Selected Tables of Atomic Spectra

The Multiplet Tables are noted in column 6 as UV and MT, respectively. Multiplet numbers from the MT are bracketed throughout to distinguish them from those in the UV Tables.

The laboratory wavelengths used to identify the solar lines as to chemical origin are recorded in column 5. Many of these values are taken from the Multiplet Tables, but additional values have been quoted from revised and extended analyses, or from more homogeneous lists of wavelengths. Certain solar identifications have been based on predicted wavelengths in cases where expected members of multiplets have never been observed in the laboratory. In these cases the appropriate multiplet numbers are entered in column 4. No multiplet numbers have been added, however, for new multiplets that are known from revised analyses of various spectra. For cases of laboratory blends, where one line has more than one designation, both multiplet numbers are given in column 4 and the wavelength is repeated in column 5. For example,

2399.25	8W	Fe II	2	2399.237
		Fe II	36	2399.237

For molecular lines the chemical symbol is entered in column 3; in column 4, instead of a multiplet number the vibrational quantum numbers are given, enclosed in parentheses.

Reference numbers for the identification work are in the last column. This reference list follows the Ledger.

The first column in the reference list indicates the spectra for which each reference has been used.

Criteria for the Identifications

One criterion for reliable identifications is satisfactory agreement between solar and laboratory wavelengths. For prominent solar lines there was rarely any question when the wavelength agreement was good and the particular spectrum was known to be well represented in the solar ledger. Throughout the identification work, however, multiplet structure was considered in detail together with wavelength agreement. The general run of solar intensities within multiplets was an important guide and blended lines were often detected from intensity anomalies. Lines that were expected but missing had to be accounted for. Masking of lines falling within the wingspan of the strongest solar lines has required extensive detailed study throughout the work.

The degree of agreement expected between solar and laboratory wavelengths varies greatly depending on the width and general character of the solar line. In addition, the accuracy of laboratory wavelengths varies widely among different spectra. For a line that appeared to be unblended, a tolerance of $\pm 0.03 \text{ \AA}$ (Sun — Lab) was taken as acceptable in most cases. For a few partially resolved blends, winged lines, or other complex features a greater tolerance was allowed.

The winged lines of Table 1 and many other strong lines often masked lines that should have been present on multiplet evidence. The decision whether to include a missing line in the ledger as a contributor to a blend, or omit it as masked was often difficult and always involved personal judgment.

A complete list of lines believed to be masked was prepared but is too long to include. A selected list of the more important masked lines is given in Table 2. The arrangement is by increasing atomic number, Z (column 1), followed by the spectrum (column 2), and by the laboratory wavelength, intensity, and multiplet number of the line believed to be masked, (columns 3, 4 and 5). The wavelength and visual intensity of the solar masking line are given in columns 6 and 7; the identification and multiplet number of the masking line are in the two columns that follow. The entries for the masking lines, (columns 6 to 9), are taken from the Solar Ledger. The last column, (Sun — Lab), gives the wavelength separation between the masking line and the missing line.

Table 2 — Selected Masked Lines

Z	Spectrum	Lab λ	Lab Int.	Mult No.	Solar λ	Solar Int.	Solar Ident.	Mult No.	$\Delta\lambda$ Solar - Lab
4	Be I	2650.550	5	2	2650.47	4	Be I— Fe II	2 410	—0.08
5	Bi	2497.7233	10R	1	2497.71	6	Fe II Fe II	128 242	—0.01
		2496.7717	8R	1	2496.77	4	Fe	—	0.00
12	Mg I	2617.513	3	14	2617.63	8W	Fe II	1	+0.12
13	Al I	2311.035	4	12	2310.96	8W	Ni I	10	—0.08
		2312.491	5	12	2312.34	7W	Ni I	10	—0.15
		3059.029	4	[7]	3059.11	8W	Fe I	[9]	+0.08
		3064.290	7	[7]	3064.23	4	OH	(0-0)	—0.06
14	Si I	2631.282	190	83	2631.33	8W	Fe II	1	+0.05
20	Ca I	2150.796	2	8	2150.75	7W	Al I Cr II Fe II	— 37 248	—0.05
		3000.863	9	[17]	3000.93	8W	Fe I	[9]	+0.07
22	Ti I	2631.526	8	5	2631.61	7	Fe II	171	+0.08
		2384.516	7	12	2384.39	6W	Fe II Ni I	36 10	—0.13
		2380.818	5	13	2380.76	8W	Fe II	3	—0.06
		2279.964	6	15	2279.92	5W	Fe II Fe I	4 16	—0.04
		2965.240	5	27	2965.26	7	Fe I	1	+0.02
		3000.892	10	[29]	3000.93	8W	Fe I	[9]	+0.04
22	Ti II	2498.930	1	10	2498.89	7W	Fe I Fe II	8 161	—0.04
		2716.250	4	13	2716.23	6D	Fe II— Fe I	261 155	—0.02
		2719.39	2	13	2719.42	5	Fe I	154	+0.03
23	Vd I	2957.30	10?	1	2957.36	7W	Fe I	1	+0.06
		2656.224	60R	13	2656.14	5	Fe I	156	—0.08
		2545.981	30r?	15	2545.97	6W	Fe I	7	—0.01
		2506.902	150R	17	2506.91	8W	Si I	1	+0.01
		2503.300	50r	17	2503.33	5	Fe II	206	+0.03
		2501.608	60R	19	2501.69	6W	Fe I	56	+0.08
		2428.269	100R	23	2428.29	6	Fe II Co II	301 7	+0.02
23	Vd II	2380.910	120	25	2380.76	8W	Fe II	3	—0.15
		2528.466	200	50	2528.51	7W	Si I	1	+0.04
		2983.558	80n	[28]	2983.59	8W	Fe I	[9]	+0.03
24	Cr I	2364.73	150r	1	2364.84	8W	Fe II	3	+0.11
		3000.88	50r	11	3000.93	8W	Fe I	[9]	+0.05
		2620.480	12	20	2620.41	7W	Fe II	1	—0.07

Table 2 — Selected Masked Lines — Continued

Z	Spectrum	Lab λ	Lab Int.	Mult No.	Solar λ	Solar Int.	Solar Ident.	Mult No.	$\Delta\lambda$ Solar - Lab
24	Cr I cont.	3020.671	50 _r	[27]	3020.63	9 W	Fe I	[9]	-0.04
		2491.35	20	31	2491.40	4 W	Fe II	207	+0.05
		2506.82	25	31	2506.91	8 W	Si I	1	+0.09
		2502.55	25 _r	32	2502.50	4	Fe I	—	-0.05
		2157.74	30 _b	44	2157.80	4	Fe I	24	+0.06
							Ni I	36	
		2739.395	20	63	2739.56	8 W	Fe II	63	+0.16
		2697.01	15	65	2697.02	5	Fe I	100	+0.01
		2778.213	12	93	2778.25	7 D	Fe I— [Mg I]	44 6	+0.04
							Fe I	14	
24	Cr II	2320.39	10	19	2320.34	6 W	Fe I	14	-0.05
		2226.35	15	35	2226.31	7 W	Ni II	12	-0.04
		2398.51	15	43	2398.56	5	Ca I	—	+0.05
		2419.87	15	43	2419.88	5	Fe I	68	+0.01
							Fe II	180	
		2723.64	60	59	2723.58	6 W	Fe I	5	-0.06
		2630.93	50	63	2631.04	8 W	Fe II	1	+0.11
							Fe II	171	
		2853.18	30	81	2852.13		Mg I	1	-1.05
		2563.58	50	89	2563.49	6 W	Fe II	64	-0.09
		2588.25	12	89	2588.27	5	Mg I	—	+0.02
		2936.92	25	95	2936.91	8 W	Fe I	1	-0.01
		2764.28	15	100	2764.33	6 w	Fe I	128	+0.05
							Cr I	15	
		2755.53	15	101	2755.74	8 W	Fe II	62	+0.21
		2755.81	10	101	2755.74	8 W	Fe II	62	-0.07
		2723.48	30	102	2723.58	6 W	Fe I	5	+0.10
		3047.62	20	[15]	3047.60	8 W	Fe I	[9]	-0.02
25	Mn I	2372.116	10 _d	2	2372.08	5 w	Al I	3	-0.04
							Al I	11	
		2097.554	30	—	2097.51	4 W	Fe II	80	-0.04
							Fe II	120	
25	Mn II	2928.678	40	17	2928.62	6	Mg II	2	-0.06
		2435.137	40	33	2435.15	7 W	Si I	45	+0.01
		2625.606	3000	19	2625.68	8 W	Fe II	1	+0.07
		2719.012	300	33	2719.04	8 W	Fe I— Fe I	5 161	+0.03
							Fe I	97	
		2722.095	300	33	2722.05	5 D	Fe II	260	-0.05
							Al I	4	
		2373.357	300	38	2373.36	5 w	Al I	4	0.00
		2956.170	100	49	2956.13	5	Ti I	1	-0.04
		2652.497	200	53	2652.49	6	Al I	1	-0.01
		3059.060	100	[21]	3059.11	8 W	Fe I	[9]	+0.05
		2883.825	100	69	2883.72	6 w	Fe II	230	-0.10
							Fe I	167	
		2656.170	200	70	2656.14	5	Fe I	156	-0.03
		2662.538	200	70	2662.58	5	Fe II—	410	+0.04
25		2943.894	200	82	2943.91	6	Ni I	24	+0.02
		2728.617	300	—	2728.63	4	Vd II	1	+0.01

Table 2 — Selected Masked Lines — Continued

Z	Spectrum	Lab λ	Lab Int.	Mult No.	Solar λ	Solar Int.	Solar Ident.	Mult No.	$\Delta\lambda$ Solar - Lab
25	Mn II cont.	2593.301	250	—	2593.24	5	Mg I	—	-0.06
							Fe I	171	
26	Fe I	2795.540	30	44	2795.53		Mg II	1	-0.01
		2908.856	8	142	2908.81	6 W	Vd II	12	-0.05
		2851.509	5	159	2851.64	6	Mg I	5	+0.13
		2606.644	4	—	2606.61	5	Mg I	—	-0.03
26	Fe II	2142.993	1	6	2143.01	5	Vd II	7	+0.02
		2186.842	8	90	2186.89	7	Fe I	22	+0.05
		2196.012	9	—	2196.04	7 W	Fe I	21	+0.03
		2168.914	4	247	2168.80	6 W	Al I	9	-0.11
		2175.113	2d	247	2175.15	6	Ni II	13	+0.04
		2954.050	4	253	2953.93	8 W	Fe I	1	-0.12
		2490.728	4	331	2490.65	7 W	Fe I	9	-0.08
		2796.644	4h	373	2795.53		Mg II	1	-1.11
27	Co I	2289.495	10	15	2289.61	5	Si I	88	+0.11
		2198.75	8	23	2198.71	6	Ge I	11	-0.04
		2764.188	7	52	2764.14	5D	Fe I	—	-0.05
							Mg II	—	
							Fe II	—	
		2325.601	3	63	2325.56	5d	Co I	14	-0.04
							Fe II	288	
27	Co II	2205.833	5B	10	2205.88	6			+0.05
		2697.040	40	13	2697.02	5	Fe I	100	-0.02
		2714.447	80	13	2714.42	7 W	Fe II	63	-0.03
		2487.400	50	16	2487.37	6d	Fe II—	385	-0.03
							Fe I	10	
		2317.069	500B	—	2317.16	7 W	Ni I	8	+0.09
		2275.387	200	—	2275.45	6	Ca I	—	+0.06
		2447.696	200B	—	2447.71	6w	Fe I	9	+0.01
							Fe II	320	
28	Ni I	2524.208	5	28	2524.28	6 W	Fe I	7	+0.07
		2211.03	3	34	2210.97	4	Fe II	118	-0.06
							Fe II	134	
		2186.94	2	37	2186.89	7	Fe I	22	-0.05
28	Ni II	2551.034	10	17	2551.10	5	Fe I	—	+0.07
							Mg I	—	
		2545.903	200	18	2545.97	6 W	Fe I	7	+0.07
		2135.127	250	—	2135.32	5D	Fe II	—	+0.19
							Fe I	—	
							Ni I	18	
							Cr II	23	
29	Cu I	2406.664	1500	19	2406.66	8 W	Fe II	2	0.00
		2138.546	500R	24	2138.58	8 W	Zn I	1	+0.03
							Ni II	13	
							Fe I	24	

Table 2 — Selected Masked Lines — Continued

Z	Spectrum	Lab λ	Lab Int.	Mult No.	Solar λ	Solar Int.	Solar Ident.	Mult No.	$\Delta\lambda$ Solar - Lab
40	Zr II	2712.38	10	3	2712.39	4	Fe II	201	+0.01
41	Nb II	2941.536	800R	14	2941.49	5	Vd II	10	-0.05
		2910.580	400R	14	2910.64	4	Cr II	211	+0.06
42	Mo II	2890.995	100	4	2891.06	6	Ti II	5	+0.06
		2923.387	100	4	2923.42	5D	Cr II Fe I Cr II	240 — 286	+0.03
44	Ru II	2678.759	800	40	2678.79	7	Cr II	7	+0.03
46	Pd II	2488.92	300	13	2488.94	5	Fe I	164	+0.02
49	Cd II	2265.018	1000	1	2265.06	6	Fe I	16	+0.04
50	Sn I	2706.510	1000R	1	2706.52	5	Ni I Cr I	70 64	+0.01
		2429.488	1000R	4	2429.51	3	Fe II	180	+0.02
		2354.837	1000R	4	2354.88	6W	Fe II	35	+0.04
51	Sb I	2528.52	2000R	8	2528.51	7W	Si I	1	-0.01
		2598.05	1500R	8	2598.37	9W	Fe II	1	+0.32
56	Ba II	2335.269	10R	2	2335.21	5d	—	—	-0.06
58	Ce II	2976.900	320	—	2976.90	4	Fe I	172	0.00
58	Ce III	3055.589	100000	[1]	3055.70	4	Fe I	—	+0.11
72	Hf II	2975.886	3000	7	2975.93	5	Fe II	60	+0.04
		2647.294	600	11	2647.25	4			-0.04
74	W I	2944.398	500R	5	2944.40	6w	Fe II	78	0.00
76	Os I	2909.061	500R	1	2909.04	4	Cr I	12	-0.02
77	Ir I	2849.725	80r	1	2849.84	7	Cr II	5	+0.12
		2543.971	200h	5	2543.91	6	Fe I	162	-0.06
78	Pt I	2893.87	6	3	2893.88	4	Fe I	88	+0.01
		2733.96	8R	3	2734.00	5	Fe I	48	+0.04
		2719.02	6R	6	2719.04	8W	Fe I— Fe I	5 161	+0.02
79	Au I	2700.90	30	4	2700.92	5	Vd II	1	+0.02
		2688.72	20	6	2688.70	5	Vd II	3	-0.02
82	Pb I	2801.991	50000R	2	2802.70		Mg II	1	+0.71
90	Th II	2837.295	1000r	—	2837.30	4	Fe II	231	0.00

PART III

GENERAL DISCUSSION

By the time of the commencement of World War II a great deal had already been learned about the chemical composition and the physical structure of the sun from diligent work on its "accessible" spectrum. The first evidence that short-wavelength emissions must exist came from the need to explain the earth's ionosphere. Proof that extreme ultraviolet radiation is emitted from the sun came soon after 1940 from the identification of the long-unexplained coronal lines in the visible (Grotrian 1939 and Edlén 1942). The green coronal line 5303\AA , for example, was produced by a forbidden transition in Fe XIV whose excitation required the emission of lines in the extreme ultraviolet near 265\AA .

The success in 1946 in obtaining observations from a V-2 rocket of the ultraviolet solar spectrum, pointed the way toward eventually observing the entire spectrum of the sun, a long-cherished dream of astronomers. New interest in the observation of the sun was immediately generated. Following the first twenty years of research based on rocket spectra, a general summary of the situation just prior to the availability of the echelle spectra was given in the 1966 Solar Monograph (Moore, Minnaert, Houtgast).

Summary of Spectra Identified

The raies ultimes of twenty-nine spectra lie within the range covered by the echelle spectrograph (Table 3). These raies ultimes include 11 first spectra, 16 second spectra, and 2 third spectra. They are the lines of these spectra that one would expect to be the strongest in the sun.

Twenty-three of the raies ultimes are present in the solar spectrum, four are masked, and two are absent. Those that are present are indicated by the symbol \dagger following the wavelength in column 5 of the Ledger.

A summary of the spectra identified in the Ledger is presented in Table 4, which includes 34 first spectra, 29 second spectra, 2 third spectra, and 2 molecular spectra. Columns 1 and 2 of Table 4 contain the atomic number and the spectrum, with molecular spectra entered at the end. Columns 3 and 4 give the approximate numbers of unblended and blended solar lines ascribed to each spec-

trum. Column 5 indicates the solar intensity of the strongest unblended line, with Mg I and Mg II omitted for reasons that are obvious.

Some Identifications of Special Interest

Hg I: In the 1966 Solar Monograph,⁴² Table 13 contained a summary of "Chemical Elements in the Sun," and stated that "Further study of Hg I is needed." On the basis of the present work Hg can no longer be considered present in the sun. See details below.

C II: Although the spectra of carbon through C VI are now familiar features in extreme ultraviolet solar spectra, when progressing from the visible to shorter wavelengths the first accessible lines of C II occur in the echelle range.

Cu II and Cd II: These spectra are observed in the sun for the first time from the presence of their raies ultimes.

Pt II: This spectrum is listed as present from the echelle data.

Yt III and Gd III: These third spectra appear in the list of newly identified spectra. For Yt III the evidence is provided by the raie ultime.

Bi, Tc II, Ce III, Tb II and Th II: The leading lines of these spectra fall within the echelle range and might be expected to be present. They are absent or masked. Special discussions of these spectra follow in the section "Comments on Spectra Absent from the Echelle Ledger."

Li I: The raie ultime, 6707.761\AA ,²⁰ is strong in the spot spectrum but is absent from the disk spectrum because of the low ionization potential of Li I. The second series member, 3232.634\AA , is absent. The third member, 2741.186\AA , agrees with a solar line observed at 2741.21\AA , but this is considered to be a chance coincidence.

Tm III: The strongest line observed in the laboratory, 2489.437\AA ,⁵⁴ is absent.

OH and SiO: Molecular spectra of OH and SiO have been identified in the echelle range and are described in the section on "Molecular Spectra." OH lines are familiar and numerous, but SiO is reported here for the first time.

Pending further observations, no identifications of the NH band at 3050\AA have been entered in the Ledger.

Table 3 — Raies Ultimes

Z	Spectrum	Lab	Z	Spectrum	Lab
4	Be I	2348.610	43	Tc II	2543.227 ^a
5	B I	2497.7233 ^m	44	Ru II	2402.72
12	Mg I	2852.127	45	Rh II	2334.77
12	Mg II	2795.528	46	Pd II	2296.53
14	Si I	2516.112	47	Ag II	2246.43 ^a
24	Cr II	2835.63	48	Cd I	2288.018
25	Mn II	2576.105	49	Cd II	2144.408
26	Fe II	2382.034	58	Ce III	3055.589 ^m
27	Co II	2286.150	71	Lu II	2615.42
28	Ni II	2216.482	72	Hf II	2641.410
29	Cu II	2135.981	76	Os I	2909.061 ^m
30	Zn I	2138.573	77	Ir I	2543.971 ^m
32	Ge I	2651.172	78	Pt I	2659.44
39	Yt III	2817.037	79	Au I	2427.95
42	Mo II	2816.153			

a = absent

m = masked

Notes on Selected Spectra

Z = 12; Mg I: The strength of the raie ultime, 2852.127Å, is enormous. Other series are well represented. The series $3p^3P^\circ - ns^3S$ is present from $n = 6$ to 13; for $n = 14$ to 21 the wavelengths are predicted. The series $3p^3P^\circ - nd^3D$ is present from $n = 5$ to 18 and may run to $n = 22$; wavelengths from $n = 14$ are predicted.

Mg II: The analogs of H and K of Ca II, 2795.528Å and 2802.704Å, are the dominant features of the entire echelle range. Three series have been

extended to the ultraviolet and identified from predicted wavelengths:

$$4s^2S - np^2P^\circ \quad (n = 6, 7)$$

$$3d^2D - nf^2F^\circ \quad (n = 10)$$

$$4p^2P^\circ - ns^2S \quad (n = 10, 11).$$

Z = 13; Al I: The series limits associated with the ground term $3p^2P^\circ$ lie at 2070.626Å and 2075.443Å. Absorption in the several series converging to these limits and beyond accounts for most of the great decrease in

Table 4 — Summary of Spectra in the Echelle Ledger: Counts of Lines

Z	Spectrum	Unbl.	Bl.	Intensity	Note	Z	Spectrum	Unbl.	Bl.	Intensity	Note
4	Be I	3	5	4h	1	38	Sr I	4	1	3	2
6	C I	3	2	4h			Sr II	1	1	3	2
	C II	2	2	2h		39	Yt II	1	1	3	2
12	Mg I	>60	>30		1,2		Yt III	1	0	2	1,2
	Mg II	10	7		1,2	40	Zr I	6	4	3	
13	Al I	>40	>30	7	2		Zr II	40±	25±	5	
	Al II	2	1	5	2	41	Nb II	4	0	3	2
14	Si I	>30	>10	9W	1,2	42	Mo I	1	0	1h	2
	Si II	2	2	2	2		Mo II	3	3	2	1,2
15	P I	7	11	5	2	44	Ru I	0	1	1±	2
20	Ca I	10	2	6	2		Ru II	3	3	3	1,2
	Ca II	6	2	5	2	45	Rh II	1	0	1	1
21	Sc I	1	2	1	2	46	Pd II	1	0	4	1
	Sc II	6	1	5	2	48	Cd I	1	0	5	1,2
22	Ti I	70±	35±	5	2		Cd II	1	0	3	1,2
	Ti II	90±	40±	6		50	Sn I	1	0	1	2
23	Vd I	30±	25±	4		51	Sb I	2	0	3h	2
	Vd II	150±	70±	6		56	Ba II	2	1?	4	2
24	Cr I	160±	100±	6		58	Ce II	6	2	3	
	Cr II	280±	180±	7	1	64	Gd II	3	2	3	
25	Mn I	80±	50±	6	2		Gd III	2	0	1	2
	Mn II	120±	80±	8W	1	71	Lu II	0	1	?	1,2
26	Fe I	770±	260±	9W	2	72	Hf II	4	2	3	1
	Fe II	>800	>300	9W	1,2	74	W I	2	0	1	2
27	Co I	200±	100±	6w		76	Os I	1	0	1h	1,2
	Co II	100±	70±	7w	1	77	Ir I	4	1	3	1,2
28	Ni I	130±	50±	8W	2	78	Pt I	9	7	4	1
	Ni II	100±	50±	7W	1		Pt II	0	1	2±	2
29	Cu I	22	8	5	2	79	Au I	3	7	3	1,2
	Cu II	14	8	5	1,2	80	Hg I	1	0	3	2
30	Zn I	6	2	5	1	82	Pb I	0	1	3h	2
31	Ga I	4	0	4	2		OH	87	75	5	2
32	Ge I	11	1	5	1,2		SiO	41	29	2	2
33	As I	2	0	2	2						

Note 1 See Table 3, Raies Ultimes

Note 2 See "Notes on Selected Spectra" below

intensity of the solar continuum short of 2100Å. Many lines in these series are present, mostly from two series:

$$3p^2P^\circ - ns^2S \quad (n = 5 \text{ to } 17); n = 17 \text{ predicted}$$

$$3p^2P^\circ - nd^2D \quad (n = 4 \text{ to } 16).$$

Al II: In multiplet 1, 2669.157Å is unblended; in multiplet 14 only the strongest member, 2637.689Å, is present and is faint. The singlet line, 2816.185Å multiplet 7, is probably blended with the raie ultime of Mo II, 2816.153Å.

Z = 14; Si I: Nearly 50 lines are present and many are strong. (see Table 5). A paper on "The Presence of Si I series in the Ultraviolet Solar Spectrum 3000Å to 1200Å" was published in 1977.⁴¹

Si II: The 4 identified lines are from multiplets 0.01 and 17.

Z = 15; P I: This spectrum was first identified in the sun from lines of $\lambda > 9100\text{\AA}$ (Moore, Babcock and Kiess 1934). This earlier work is well confirmed by the presence of some 20 low-level lines in the echelle range.

Z = 20; Ca I: The series $4s^2\ ^1S - 4s\ np\ ^1P^\circ$, of which 4226.727Å is the leading member, extends from $n = 5$ to 9.

Ca II: The identifications are based on predicted wavelengths, all believed to be reliable.

Z = 21; Sc I: Multiplets [10] and [11] are faintly present. The one unblended line is 3014.364Å.

Sc II: Three leading lines of multiplet 1 are unblended. The remaining lines are from multiplets 2 and [37].

Z = 22; Ti I: The strongest multiplets, 1, 2, and 5, are well represented, and contain only a few blends.

Z = 25; Mn I: The strongest lines are from multiplet 1 and are unblended.

Z = 26; Fe I: The ultimate lines of Fe I are among the strongest Fraunhofer lines (see Table 5). Almost every known line of Fe I is present in the spectrum of the solar disk and many as yet unidentified lines are probably lines of Fe I.

The most extensive line list of Fe I is found in the paper "Iron-Neon Hollow Cathode Spectrum" by H. M. Crosswhite.⁷ In addition C. M. Brown and associates¹ have observed Fe I in absorption from 2142Å to 1550Å; more than 60 of these lines have been identified in the echelle spectrum. About 70 unclassified lines of Fe I from the early Princeton line list⁵¹ have also been identified.

Use was made of two extensive lists of predicted Fe I lines that have not been published⁴³: a list by J. L.

Tech, based on "Atomic Energy Levels" and 12 miscellaneous levels,²⁹ and a similar list by C. M. Brown, which includes recent work by U. Litzén.⁵¹ More than 200 of these predicted lines have been identified in the echelle spectrum.

Fe II: A revised and extended analysis of Fe II by S. Johansson²³ was used extensively. In addition, wavelengths predicted from Johansson's term values provided identifications of more than 30 unidentified solar lines. The most important predicted lines are found in multiplets 4 and 32.

Z = 28; Ni I: The strongest lines are from multiplet 24. The following unclassified lines have been identified from UV, Ref A:

Laboratory Wavelength	Int.	Laboratory Wavelength	Int.	Laboratory Wavelength	Int.
2277.767	6	2313.649	5	2703.615	2
2308.168	4	2322.683	5	2903.653	1
2309.484	4	2346.074	3	2932.618	4
2310.016	3	2559.655	6		

A few Ni I lines have been identified from predicted wavelengths.³⁸ The level values in Ref. 48 have been used.

Z = 29; Cu I: Only the strongest lines from the two lowest terms are present.

Cu II: The presence of the raie ultime provides the first evidence of Cu II in the solar spectrum. This spectrum has excellent "Reference Wavelengths".²⁵

Z = 31; Ga I: Three lines from multiplet 1 and one from multiplet 3 appear to be unblended.

Z = 32; Ge I: The leading lines, multiplets 1 and 2, are present and unblended. A few lines from the second lowest term are also present. All of the Ge I lines are in the list of "Reference Wavelengths".²⁵

Z = 33; As I: The presence of As I in the sun was reported in 1976.³⁹ The raie ultime, 1890.42Å, was identified by C. M. Brown in a rocket spectrogram and all three members of multiplet 1 appear to be present. On the basis of this evidence two lines near 2300Å in the echelle spectrum have been attributed to the leading lines of As I, multiplet 6.

Z = 38; Sr I: Five members of the series $5s^2\ ^1S - np\ ^1P^\circ$ ($n = 6$ to 11) appear to be present but faint; one is masked.

Sr II: The two leading lines of multiplet 3 near 2160Å appear to be present but faint.

Z = 39; Yt II: The two leading lines of multiplets 1 and 2 are accessible and present.

Yt III: The leading lines of multiplet 3 are 2817.037Å and 2946.014Å. The solar line 2817.04Å is identified as Yt III and provides the first evidence of the presence of this spectrum. The second line is absent.

Z = 41; Nb II: The identified lines are from multiplets 9, 14 and 15. The raie ultime, 3094.172Å, is outside the present range.

Z = 42; Mo I: Only the strongest accessible line, 2225.437Å multiplet 2, is present; it is faint and hazy.

Mo II: Six lines of multiplet 4 are present but faint; three are blended.

Z = 44; Ru I: The leading line of multiplet 1, 2874.984Å, may contribute to a solar line of intensity 3 due mostly to Cr II.

Ru II: Five lines of multiplet 41 and the strongest line of multiplet 42 are the only lines entered as present.

Z = 48; Cd I: In the 1966 Solar Monograph⁴² the low-level intersystem line of Cd I, 3261.050Å, was listed as present. The presence of the raie ultime as an unblended line in the echelle spectrum confirms the earlier work.

Cd II: The raie ultime is the violet component of a close pair of lines. The second member of multiplet 1 is masked. No other lines of Cd II have been observed in the solar spectrum.

Z = 50; Sn I: A faint solar line at 2863.30Å, is identified as Sn I (multiplet 1).

Z = 51; Sb I: The two accessible lines in multiplet 1 are present but faint.

Z = 56; Ba II: Multiplet 2 is present. The second and third lines are unblended. The strongest line, 2335.269Å, probably contributes to the double solar line 2335.21Å, intensity 5d, which is unidentified. The wavelength discrepancy is unexplained; therefore the Ba II line is listed in Table 2 as masked.

Z = 64; Gd III: The two leading lines, 2955.534Å, and 2904.726Å, appear to be present, but faint. This is the first identification of Gd III in the solar spectrum.

Z = 71; Lu II: The presence of the raie ultime as the principal contributor to a solar blend confirms the presence of three lines attributed to Lu II in the 1966 Solar Monograph.⁴²

Z = 74; W I: The strongest accessible line, 2946.989Å, is very faint in the echelle spectrum. The presence of the second line, 2818.060Å, is dubious.

Z = 76; Os I: The raie ultime is masked. A weaker but strongly reversed line, 2838.626Å, multiplet 12, appears to be present but faint.

Z = 77; Ir I: The identification of Ir I at $\lambda > 3000\text{\AA}$ is confirmed by the presence of three reversed laboratory lines in the present range. The raie ultime is masked.

Z = 78; Pt II: The first and only evidence of Pt II in the solar spectrum is from 2144.244Å, which is observed in the laboratory as a blend of Pt I and Pt II.

Z = 79; Au I: In the 1966 Solar Monograph⁴² one line, 3122.784Å, is identified as Au I; this was the only evidence of gold in the sun. In the echelle range the presence of 10 lines confirms the earlier assignment. Blending is troublesome, but the strong line 2352.58Å, multiplet 5, is unblended. The raie ultime is blended with Mn II.

Z = 80; Hg I: The familiar intersystem line, 2536.517Å, multiplet 1, is present in the echelle spectrum. The correctness of this identification is supported by the raie ultime, 1849.492Å, multiplet 2, found present in absorption in a rocket spectrogram photographed by NRL. This solar line was measured at 1849.50Å and identified by C. M. Brown. These two solar lines are the first and only lines attributed to Hg I.

Z = 82; Pb I: The strong line, 2833.060Å, multiplet 1, may contribute to a solar line due partly to Fe II. The first line in multiplet 2 is masked by Mg II.

Comments on Spectra Absent from the Echelle Ledger

Z = 5; Bi: The search for Bi in the solar spectrum has been unrewarding,³⁹ and this holds true for the echelle spectrum as well. The leading lines, 2497.7233Å and 2496.7717Å¹¹ are masked. The solar line in the present ledger at 2496.77Å is attributed to an unclassified line⁷ of Fe, 2496.792Å, rather than to Bi. The analysis by Kchl et al. (1977) of the Harvard-Smithsonian spectrum for Bi does not take into consideration this line of Fe.

Z = 43; Tc II: The possible presence of technetium in the sun was noted in 1951 on the basis of leading lines of Tc II longer than 3000Å, but the evidence was inconclusive.³⁶ The raie ultime, 2543.227Å, multiplet 1, is absent from the echelle spectrum. The second line in the multiplet, 2609.993Å, coincides with a line of Fe ascribed to the faint solar line 2610.00Å. The third member of the multiplet is absent.

As was stated³⁶ in 1951, the identification depends upon the existence in nature of an isotope having a half-

life "of the order of 4×10^8 years or more." More recently, Cahn and Glashow (1981) state that the most stable isotope has a half-life of only 4.2×10^6 years. Therefore, no definitive statement regarding the presence of Tc is justified.

Z = 58; Ce III: This spectrum deserves special mention. The raie ultime, 3055.589\AA ⁵³ is masked in the echelle spectrum. In the 1966 Solar Monograph⁴² a faint Rowland line at 3055.594\AA is identified as "Ce III?", the only third spectrum included.

Z = 65; Tb II: E. Meinders³⁴ reports 32 strong, classified lines in the echelle range. Of these, only 2 might be present unblended: 2897.444\AA and 2914.755\AA , having respective solar intensities 1 and 2. This evidence is so dubious that no solar lines have been attributed to Tb II. The presence of Tb II in the sun still remains questionable, as stated in 1966.⁴²

Z = 90; Th II: The raie ultime, 4019.129\AA , provides the only evidence of the presence of a radioactive element in the solar spectrum. The next strongest line, 2837.295\AA ⁵⁹, is masked by Fe II in the present ledger.

Molecular Spectra

OH: the leading bands of the $A^2\Sigma^+ - X^2\Pi$ system, (0-0), (1-1), and (2-2), are strongly represented in the solar spectrum at $\lambda > 3000\text{\AA}$.⁴⁰ They account for 175 unblended solar lines and contribute to 124 blends. In the above reference it is noted that the (1-0) and (2-1) bands should be present and "may be detected when high-dispersion rocket spectra become available." In fact, the (1-0), (2-1), (0-0), and (3-2) bands fall in the echelle region and are present, the (1-0) band being the strongest with the leading lines, 2833.843\AA and 2835.530\AA , each having solar intensity 5.

Approximate counts of the identified OH lines are as follows:

OH $A^2\Sigma^+ - X^2\Pi$

Band	Unblended	Blended	Total
0-0	10	3	13
1-0	56	46	102
2-1	14	20	34
3-2	7	6	13
Total	87	75	162

SiO: The $A^1\Pi - X^1\Sigma^+$ system is judged to be present in the echelle spectrum. Some 70 lines are entered in the ledger; about 40% are blends. The evidence comes from (0-1), (1-0), and (2-0) bands.

The strongest unblended SiO lines have intensity 2. The visibility of the lines varies with the contrast in the spectrum, the stray light level, and with the presence or absence of strong competing lines, especially in the presence of broad and winged features. This accounts for the fragmentary appearance of the branches. Solar temperatures of 4000-5000K, which prevail in the solar atmosphere where SiO would be present, would require the rotational lines to peak in intensity at quantum number N = 40. The observations are consistent with this behavior.

A summary of the values of N for the lines identified in the three branches of the SiO bands is as follows:

SiO $A^1\Pi - X^1\Sigma^+$
Observed Rotational Quantum Numbers (N)

Band	P Branch	Q Branch	R Branch
0-1	absent	45-58	24-37, 49-65
1-0	31-38	16-47	24-50
2-0	absent	72-92	70-89

The (0-0) band should occur between 2345\AA and 2388\AA , but laboratory observations are lacking. The wavelengths in this interval have been calculated from the constants of the $X^1\Sigma^+$ state and the energy levels of the $A^1\Pi$ state determined from the (0-1) band, as given by A. Lagerqvist and U. Uhler.³¹ The evidence for the (0-0) band from these data was inconclusive; hence no lines from the (0-0) band are included in the ledger.

Although some lines in the various branches studied are absent and numerous lines are masked, enough are present or accounted for to confirm the presence of SiO.

The counts of identified lines of SiO are given below:

SiO $A^1\Pi - X^1\Sigma^+$

Band	Unblended	Blended	Total
0-1	9	13	22
1-0	19	12	31
2-0	13	4	17
Total	41	29	70

NH: The presence of NH in the solar spectrum is well established in the 1966 Solar Monograph.⁴² The (0-0) and (1-1) bands of the $A^3\Pi_1 - X^3\Sigma^-$ transition are red-degraded and have short wavelength limits at 3280Å and 3307Å, respectively. They are represented in this Monograph by 265 lines, 159 of which are unblended.

The (1-0) band is expected near 3050Å. This wavelength is at the extreme end of the present compilation, and overlaps a poorly observed region of the Rowland Table where the solar observations are discontinuous and fragmentary. Therefore, no identifications have been made, although this band may well be present. Laboratory observations by R. N. Dixon⁹ indicate that the (1-0) band is of strength comparable to the (0-0) and (1-1) bands. Further laboratory observations of the (1-0) band are needed.

Interpretation of Winged Lines

In the course of the early work on the Revision of Rowland's Preliminary Table of Solar Spectrum Wavelengths, (St. John et al. 1928) a study was made of the winged lines in the solar spectrum, 3000Å to 9000Å (Moore and Russell 1926). The strong, winged lines and those lines which were conspicuously hazy were selected by examining the Rowland and Mount Wilson photographs of the solar spectrum. These selected lines, totaling 138 were "subdivided into four groups according to the degree of widening"; group 1 contained the least widened lines and group 4 included only the H and K lines of Ca II. Eleven elements were represented: Fe, Mg, Ca, Ni, H, Ti, Na, Al, Si, Cr, and Sr.

By listing the widened lines of each spectrum in multiplet form it was shown that all originated in low energy levels, those from the lowest levels being the most widened. Strong members of multiplets were more widened than the weaker ones. The order of the elements listed above is roughly that of decreasing "total widening."

The study of the winged lines can now be extended to 2100Å from the data in Table I. Allowance must be made, however, for the fact that for $\lambda > 3000\text{\AA}$ the lines were selected from prints, while in the present work, the selection was made from photometric tracings. The earlier work has been extended by the same method of analysis. The lines in Table I have been divided into five groups according to the degree of widening, where Group 1 represents the least widened and Group 5 only the Mg lines. The distribution by groups is as follows:

Group	1	2	3	4	5
Width (Å)	0.3-0.5	0.6-0.9	1.0-1.9	2.0-5.0	>5.0

The winged lines are listed by spectra and in multiplet form in Table 5. The multiplets are taken from the Ultraviolet Multiplet Table except for one line of Fe I, 2983Å, which is from the Princeton Multiplet Table of 1945 as indicated by placing the multiplet number in brackets. These references are "UV" and "MT" respectively, in the solar ledger. The wavelengths quoted in the Table are those given in the Ledger. In some cases they differ from those in the Multiplet Tables because later reference material was used. The last column gives the widths grouped as described above. As was noted in the 1926 paper, the lines having the lowest excitation potentials are the most widened, in general, and the leading members of multiplets are widened more than the weaker ones.

Table 6 is a summary of the estimates of widening of winged lines in the echelle spectrum. A total of 76 unblended lines is included. The number of lines of each spectrum in Table I is tabulated for each width-group. Most of the lines are due to Fe and the strongest are produced by Mg. This table is essentially an extension of Table II in the 1926 paper, where it is stated that "The main cause of widening is shown to be almost entirely the abundance in the solar atmosphere of atoms which are in a condition to absorb the line in question." The extension of the range of the solar spectrum to 2100Å provides a more balanced comparison of widening and abundance. For example, the ultimate lines of Si I can now be included, whereas only one faint line (EP = 1.90 eV) was accessible at $\lambda > 3000\text{\AA}$. Mn II is also added. The earlier conclusions are well-confirmed in the present work.

Counts of Lines in the Ledger

The total number of lines recorded in the ledger is 6150. Of these, 3820 (62%) have been assigned a single identification, and 1100 (18%) are judged to be blends of two or more lines. In spite of careful literature search, some 20% or 1230 lines still remain unidentified. The strongest unidentified lines are listed in Table 7, which includes all unidentified lines having a solar intensity 4 or greater, totaling 150. These lines, in particular, are a challenge to those who continue work on the interpretation of XUV solar spectra.

Table 5 — Winged Lines: Spectra and Multiplets

Wavelength Å	Laboratory				Sun	
	Int.	E P	J	Multiplet No.	Int.	Width
Mg I						
2852.127†	300R	0.00	0-1	$3s^2 1S - 3p^1 P^o$ 1	—	5
2779.831	12	2.70	2-2	$3p^3 P^o - 3p^2 3P^+$	7W	1*
2779.831	12	2.70	1-1	6		1*
Mg II						
2795.528†	50	0.00	0½-1½	$3s^2 S - 3p^2 P^o$	—	5
2802.704	50	0.00	0½-0½	1	—	5
2936.509	35	4.41	1½-0½	$3p^2 P^o - 4s^2 S^+$ 2	7W	2*
Si I						
2516.112†	250r	0.03	2-2	$3p^2 3P - 4s^3 P^o$	9W	3
2519.202	100r	0.01	1-1	1	8W	1
2528.509	175r	0.03	2-1		7W	1
2524.108	125r	0.01	1-0		7W	2*
2506.897	150r	0.01	1-2		8W	1
2514.316	100r	0.00	0-1		8W	1
2881.579	200r	0.78	2-1	$3p^2 1D - 4s^1 P^o$ 43	8W	4
2435.154	100r	0.78	2-2	$3p^2 1D - 3d^1 D^o$ 45	7W	2
Mn II						
2576.105†	400	0.00	3-4	$a^7 S - z^7 P^o$	8W	2
2593.722	300	0.00	3-3	1	7W	3
2605.682	1000	0.00	3-2		6W	1
Fe I						
2983.570	125R	0.00	4-3	$a^5 D - y^5 D^{o+}$ [9]	8W	2
2966.898	125R	0.00	4-5	$a^5 D - y^5 F^{o+}$	9W	3
2973.235	60R	0.05	3-4	1	8W	2*
2973.132	60R	0.09	2-3		7W	2*
2936.903	60R	0.00	4-4		8W	2*
2947.876	60R	0.05	3-3		8W	3
2953.940	50R	0.09	2-2		8W	2
2912.157	20r	0.00	4-3		7W	1
2719.028	60R	0.00	4-3	$a^5 D - y^5 P^{o+}$	8W	4*
2720.903	40r	0.05	3-2	5	7W	4*
2723.578	15	0.09	2-1		6W	2
2742.406	30r	0.09	2-2		6W	2
2737.310	20r	0.11	1-1		6W	3*

Table 5 — Winged Lines: Spectra and Multiplets — Continued

Wavelength Å	Laboratory			Multiplet No.	Sun	
	Int.	E P	J		Int.	Width
Fe I cont.						
2522.849	40R	0.00	4-4	$a^5D - x^5D^{\circ+}$	8W	1
2527.435	15r	0.05	3-3	7	7W	1
2501.132	20R	0.00	4-3		7W	2
2510.835	15R	0.05	3-2		7W	1
2524.293	8r	0.11	1-0		6W	2*
2549.613	10r	0.05	3-4		6W	1?
2545.978	10r	0.09	2-3		6W	2
2540.972	10R	0.11	1-2		6W	2
2483.271	60R	0.00	4-5	$a^5D - x^5F^{\circ+}$	8W	2
2488.143	40R	0.05	3-4	9	8W	2
2490.644	30R	0.09	2-3		7W	3*
2491.155	20R	0.11	1-2		6W	3*
2462.647	10r	0.00	4-4		8W	1
2472.910	12R	0.05	3-3		8W	1
2479.776	20R	0.09	2-2		7W	2
2788.104	30	0.86	5-6	$a^5F - y^5G^{\circ+}$	7W	2
				44		
Fe II						
2599.395	14	0.00	4½-4½	$a^6D - z^6D^{\circ+}$	9W	4*
2611.873	13	0.05	3½-3½	1	9W	3
2617.618	12	0.08	2½-2½		8W	3
2621.669	10	0.12	0½-0½		8W	2
2585.876	13	0.00	4½-3½		9W	4
2598.369	14	0.05	3½-2½		9W	4*
2607.086	13	0.08	2½-2½		9W	3
2613.820	13	0.11	1½-0½		8W	3
2625.664	13	0.05	3½-4½		8W	3
2631.321	13	0.08	2½-3½		8W	3*
2631.045	13	0.11	1½-2½		8W	3*
2628.291	13	0.12	0½-1½		8W	3
2382.034‡	9	0.00	4½-5½	$a^6D - z^6F^{\circ+}$	9W	4
2395.627	9	0.05	3½-4½	2	9W	4
2404.882	9	0.08	2½-3½		9W	3
2410.521	9	0.11	1½-2½		8W	3*
2413.308	9	0.12	0½-1½		8W	2
2373.733	8	0.00	4½-4½		8W	2
2388.629	9	0.05	3½-3½		8W	3
2399.237	9	0.08	2½-2½		8W	2
2406.660	9	0.11	1½-1½		8W	1
2411.062	9	0.12	0½-0½		8W	3*
2343.495	8	0.00	4½-3½	$a^6D - z^6P^{\circ+}$	9W	4
2332.798	8	0.05	3½-2½	3	9W	3
2327.391	7	0.08	2½-1½		7W	2
2364.825	8	0.05	3½-3½		8W	2
2348.300	8	0.08	2½-2½		8W	2*

Table 5 — Winged Lines: Spectra and Multiplets — Continued

Wavelength Å	Laboratory				Sun	
	Int.	E P	J	Multiplet No.	Int.	Width
Fe II cont.						
2338.005	8	0.11	1½-1½	$a^6D - z^6P^{\circ+}$	9 W	4
2380.757	7	0.08	2½-3½	3	8 W	1
2359.111	8	0.11	1½-2½	continued	8 W	3*
2359.999	8	0.23	4½-4½	$a^4F - z^4F^{\circ+}$	7 W	3*
2331.308	7	0.23	4½-3½	35	7 W	1
2354.884	5	0.35	2½-1½		6 W	1
2348.118	8	0.23	4½-3½	$a^4F - z^4D^{\circ+}$	7 W	2*
2360.287	8	0.30	3½-2½	36	7 W	3*
2368.593	7	0.35	2½-1½		7 W	2
2375.192	7	0.38	1½-0½		7 W	1
2379.275	7	0.30	3½-3½		7 W	1
2755.733	15	0.98	3½-4½	$a^4D - z^4F^{\circ+}$	8 W	2
2749.324	14	1.04	2½-3½	62	7 W	3*
2746.487	14	1.07	1½-2½		7 W	3*
2743.196	14	1.09	0½-1½		7 W	1
2739.545	15	0.98	3½-3½	$a^4D - z^4D^{\circ+}$	8 W	3
2746.978	14	1.04	2½-2½	63	7 W	3*
2749.178	13	1.07	1½-1½		7 W	3*
2749.482	12	1.09	0½-0½		6 W	3*
2714.414	13	0.98	3½-2½		7 W	2
2727.549	13	1.04	2½-1½		7 W	2
2736.968	12	1.07	1½-0½		6 W	3*
2562.535	13	0.98	3½-2½	$a^4D - z^4P^{\circ+}$	7 W	2
2563.472	12	1.04	2½-1½	64	6 W	1
2566.908	9	1.07	1½-0½		6 W	1
2582.582	10	1.07	1½-1½		6 W	2
2577.920	9	1.09	0½-0½		7 W	1
Ni I						
2337.484	50	0.00	4-3	$a^3F - w^3D^{\circ+}$	7	m
2317.159	50	0.16	3-2	8	7 W	1
2329.963	50	0.27	2-1		7 W	1
2320.026	100	0.00	4-5	$a^3F - y^3G^{\circ+}$	8 W	1
2325.794	50	0.16	3-4	9	7 W	1
2310.952	100	0.00	4-4	$a^3F - w^3F^{\circ+}$	8 W	2
2312.335	50	0.16	3-3	10	7 W	1

‡ Raie Ultime.

† Complete multiplet not listed.

* Blend.

m Masked.

Table 6 — Winged Lines — Estimates of Widening

Spectrum	Degree of Widening					No. lines	Total Widening
	5	4	3	2	1		
Fe I			2	11	7	20	35
Fe II		5	10	12	10	37	84
Mg I	1					1	5
Mg II	2					2	10
Si I		1	1	1	4	7	13
Ni I				1	5	6	7
Mn II			1	1	1	3	6

Table 7 — Strongest Unidentified Solar Lines

Wavelength Å	Int.	Wavelength Å	Int.	Wavelength Å	Int.	Wavelength Å	Int.	Wavelength Å	Int.
2121.91	6	2282.73	4	2434.68	4	2619.03	5	2736.88	5
2129.12	4d	2286.85	4	2452.84	4	2624.13	4	2740.88	4
2144.44	4	2290.49	4	2463.63	4	2634.35	4	2753.80	4
2154.34	4	2294.86	4	2466.30	4	2636.79	5	2753.86	4
2168.36	4	2300.30	4	2469.94	4	2636.96	4	2753.98	4
2175.92	4	2310.78	4	2500.23	4	2639.16	4	2759.91	4
2181.65	4	2313.35	4	2500.65	4	2647.25	4	2774.02	4
2198.43	4	2315.59	5	2509.27	4	2648.45	4	2778.75	4
2203.54	4	2319.24	4h	2555.78	4	2649.23	4	2781.00	4
2204.09	5	2321.45	5	2559.33	4	2649.63	4	2791.51	4
2205.88	6	2323.09	4	2565.02	4	2652.10	4	2813.07	4
2224.47	6	2325.13	4	2565.74	4	2652.16	4	2813.16	4
2232.89	4	2327.23	4	2569.93	4	2653.26	4	2816.77	4
2234.18	4	2328.59	5w	2570.48	5	2657.44	4	2835.38	4
2237.73	4	2331.77	5	2570.93	4	2661.67	5	2837.04	4
2240.27	4	2343.74	5	2575.32	4	2663.64	4	2842.90	4
2242.88	5	2345.84	4	2582.80	4	2666.44	5	2843.79	5
2243.39	4	2346.74	4	2585.26	4	2669.41	4	2878.63	4
2246.29	4w	2347.08	4	2590.31	4	2678.65	4	2883.65	4
2249.26	5	2347.88	4	2590.93	4	2679.21	4	2888.03	4
2257.67	4	2349.14	4	2594.43	4	2688.24	4	2908.19	4
2262.45	4	2349.62	4	2596.43	5	2696.37	4	2909.87	4
2267.37	4	2353.55	4	2597.14	4	2698.03	4	2918.16	4
2268.47	4	2354.09	4d	2599.14	4w	2698.76	4	2925.52	4
2269.04	5	2356.58	5	2604.01	5	2722.32	4	2942.99	4
2270.07	5	2420.53	4	2614.33	4	2723.78	4	2957.63	4
2270.44	5	2420.60	4	2615.21	4	2734.44	4	2962.40	4
2272.70	5	2423.02	4	2615.99	5	2735.01	5d	2965.88	4
2279.57	4	2424.65	4	2616.40	4d	2736.20	4	3039.60	4w
2280.10	4	2425.42	4	2617.36	4w	2736.75	5	3058.96	4

PART IV

OTHER SOLAR OBSERVATIONS

High-resolution solar spectra in wavelength ranges that overlap or lie within the range of the present ledger have been obtained by several other groups. In the analysis of the echelle spectra no use was made of these later spectra, other than the occasional examination of an uncertain feature, or the search for a line expected but not found. Thus, the present solar line list is independent of results obtained by others. Similarly, the identifications are independent of identifications proposed by others; they depend only on the results from original laboratory spectroscopic work and the multiplet tables quoted as UV and MT.

The user of this ledger is encouraged, however, to make comparison with the results obtained by others. To facilitate comparison, a listing of relevant publications together with brief comments is presented in this part.

The Range Accessible from the Ground

A revision of the ultraviolet spectrum in the range 3650Å to 3000Å has been published by Mohler and Mitchell (1969). This was based on new tracings of the solar spectrum obtained with the McMath-Hulbert vacuum spectrograph in Michigan, and also with a similar instrument operated at the Mt. Wilson Observatory. Intercomparison with the Second Revision of Rowland's Table (Moore, Minnaert, Houtgast 1966) resulted in the reporting of several hundred new lines and proposed identifications.

The most extensive revision of the solar spectrum has been carried out by Pierce and Breckenridge (1973) with the McMath solar telescope at the Kitt Peak National Observatory (KPNO). In the range 2975Å to 3069Å the total number of lines listed is approximately the same as in the echelle ledger. Between 2918.82Å, the limit of the spectrum recorded by the KPNO, and 2975Å, the present echelle ledger contains about half again more lines. The wavelength accuracy of the KPNO results is exceedingly high, owing to the availability of a large number of photographic spectra, and the fact that standard spectra from a thorium hollow-cathode lamp were exposed on many of the plates just above and below the solar spectrum.

The Harvard-Smithsonian Atlas 2252Å to 3196 Å

On May 15, 1974 the Harvard-Smithsonian Center for Astrophysics flew an Aerobee rocket carrying a Fastie-Ebert photoelectric scanning spectrophotometer having a spectral resolution of 0.028Å. The results are presented in an Atlas (Kohl et al. 1978). Curves of intensity distribution are given for the center of the solar disc, and also for a region near the limb ($\mu = 0.23 \pm 0.04$).

From the point of view of spectral resolution the NRL and Harvard-Smithsonian curves are much alike, as should be, since the FWHM of the respective instrumental profiles was nearly the same. Likewise, each Atlas has regions where the data suffer from excessive noise, photographic and photoelectric. The intensity information in the Harvard-Smithsonian is superior, owing to the use of photoelectric recording, and because the stray-light level associated with the holographic grating and photoelectric detection was low.

The Hawaii Atlas — 2678Å to 2931Å

On June 19, 1974, only a month after the Harvard-Smithsonian flight, an echelle spectrograph with photographic recording was flown by Allen, McAllister, and Jefferies (1978) of the University of Hawaii. Culminating a development commenced in 1958 by McAllister and Rense at the University of Colorado, this instrument made use of an echelle grating crossed with a plane grating ruled with 1200 grooves per mm. Owing to the availability of a greatly improved echelle grating of 79 grooves per mm, a spectral resolution of the order of 0.02Å was achieved. Long-wavelength stray light was suppressed by the use of "solar blind" reflecting coatings (Hass and Tousey, 1959; Austin, 1969). Wavelengths were determined by reference to 350 lines, selected with the aid of the NRL Atlas and Preliminary Ledger. Rather than rely on photographic photometry for deriving values of the intensity, the curves were normalized in 5-Å intervals to the Harvard-Smithsonian Atlas. Over the range that it covers, the Hawaii Atlas is definitive. No line list has been published.

The Interferometer Spectrograph — 2756Å to 2831Å

A spectrograph that combined an echelle grating and a Fabry-Perot interferometer in crossed dispersion was developed jointly by the Culham Laboratory and the Queen's University of Belfast. (Bradley 1968; Bates et al. 1969, 1971). The spectral range covered on the flight of December 1968 was 2765Å to 2822Å, with a spectral resolution of 0.03Å. Improvements made in the instrument led to the attainment of 0.016Å-resolution over the interval 2756Å to 2831Å on November 27, 1969. A line list with identifications was published for the first spectra by Greve, McKeith and McKeith (1973) and another by Greve and McKeith (1974) for the second spectra. Identifications made in the latter were updated by Greve and McKeith (1977) from a comparison with the Harvard-Smithsonian Atlas.

In the first publication the solar line list was compared with the NRL Preliminary List, then available as a private communication. Although the spectral resolution of both instruments was about 0.03Å, more lines were listed than were found by NRL and there were many differences. Some of the differences can be attributed to the use of the NRL Ledger that was preliminary and from which some 10% of the solar lines in this range were discarded when preparing the Final Ledger. However, this is not a sufficient explanation because the line list from the second flight of the interferometric instrument contains only about 15% more lines than are present in the first list for the same spectral range, even though the spectral resolution was improved by a factor of two. Furthermore, the two interferometric lists are not in as close agreement as might be expected, especially for lines that are broad or weak. A detailed comparison with the Final Ledger has not been attempted. The agreement is believed satisfactory for the stronger lines, but not so for those that are weak.

Short Wavelength Echelle Spectra

An echelle spectrograph with all-reflecting optics that covered a spectral range of approximately 1000Å was designed and constructed by the Culham Laboratory group (Boland, Jones and Engstrom 1971a). Both this instrument and the NRL spectrograph used replicas of the same echelle master grating. The all-reflecting design made it possible to suppress stray light of longer

wavelengths by the use of selectively reflecting coatings and therefore to reach a shorter wavelength limit. From the flight of April 22, 1969 the spectra spanned the interval 2206.270Å to 2019.273Å with a resolution of 0.03Å, the same as for the NRL spectra. Improvements made in the reflecting coatings and thermal stability made it possible on the flight of March 20, 1973 to reach 1400Å and to secure a resolution of 0.025Å. (Boland et al. 1975)

A line list with identifications and analyses was published for the 1969 spectra by Boland et al. (1971b). In general there is excellent agreement with the present Ledger. The list extends about 85Å to shorter wavelengths and contains more lines as the end of the NRL coverage at 2095Å is approached. A revision of the list from the 1969 spectra, taking into account the spectra obtained in 1973, has not come to our attention.

Identifications Made by Others

The line identifications of Greve, McKeith and McKeith (1973) and of Greve and McKeith (1977) differ from those in the present ledger because of the inclusion of all lines from the laboratory literature that were in wavelength agreement with the particular solar feature to within the resolution-element of the spectrograph. In the NRL ledger, many such lines were excluded after consideration of the lack of importance of their contributions to the solar features, in order to identify the solar lines as positively as possible.

The line identifications of Boland et al., (1971b) were based mainly on the ultraviolet multiplet tables of Moore (UV), and the tables of Junkes, Salpeter and Milazzo (1965). They are consistent, in general, with those in the present ledger.

The line identifications included in the Harvard-Smithsonian Atlas were made by a procedure quite unlike that used in the present work. The identifications are based mainly on the exhaustive compilations of atomic gf -values published by Kurucz and Peytremann (1975) and are presented in the form of a synthetic spectrum. A recent extension of the spectral synthesis work by Kurucz and Avrett (1981) includes contributions of several molecular species.

As a final check on the major remaining unidentified lines in the present work, the 1975 compilation of gf -values was searched by C. M. Brown for coincidences. The only coincidences that were considered significant were found in Fe II.

PART V

ACKNOWLEDGMENTS

Completion of this publication brings to an end a project which commenced twenty years ago. In the preparation of this final ledger, the work was divided as follows: Selection of the solar lines that appeared to be real features, estimation of their visual intensities, and the final determination of wavelengths were carried out by R. Tousey, who has had the overall responsibility for the program since its inception. In close association since the very beginning has been C. E. Moore. Identification of the solar lines and the decisions as to contributors, blending, and masking were her responsibility. C. M. Brown supervised the work on molecular lines and surveyed the literature. The section on Molecular Spectra was provided by him. In addition, he has taken charge of the computer programming and the preparation of the tables for publication.

To thank individually all who contributed to this extended project is hardly practicable. We are most grate-

ful to all who have participated. Contributions best described as invaluable were made by several colleagues formerly at NRL. J. D. Purcell developed the instrumentation and prepared the spectra in a form suitable for study. L. E. Giddings prepared the first line list and P. A. Simmons provided the identifications in the preliminary list. E. Milone contributed in many ways during more than a decade of part-time association. The Atlas was the responsibility of S. G. Tilford.

We are indebted to many individuals who have provided spectroscopic data and assistance in general. In particular, we thank B. Edlén and S. Johansson of Lund, L. Iglesias of Madrid, and W. C. Martin and R. Zalubas of the National Bureau of Standards.

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PART VI

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Appendix
THE ECHELLE LEDGER

The Echelle Solar Spectrum

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2095.46	3	Fe I	31	2095.462	1	2103.05	2	Fe I	31	2103.053	1
2095.67	3	Si I	95.04	2095.64	37	2103.21	1	Si I ICa II	95.03 9	2103.205 2103.235	37 12
2096.04	2	Al I Fe I	28	2096.037 2096.059	38 1	2103.36	1	Ni II	31	2103.392	52
2096.68	3 W	Al I		2096.609	15	2103.66	5 W	Al I Al I		2103.658 2103.680	15 15
2097.09	3	Ni II	31	2097.094	52	2103.97	1	Fe I	31	2103.973	UV
2097.51	4 W	Fe II Fe II	120 80	2097.508 2097.548	23 23	2104.40	2	Fe I		2104.412	1
2097.90	3	Al I? Fe I		2097.860 2097.875	38 1	2104.76	2	Cu II	15	2104.797	25
2098.13	3	Fe I	31	2098.119	1	2105.11	1	Cu I	23	2105.112	UV
2098.71	5 W	Al I		2098.735	15	2105.25	1				
2099.00	5 W	Fe I Al I	34	2098.939 2099.060	1 14	2105.33	2				
2099.75	5 W	Al I		2099.765	15	2105.50	2				
2100.16	1	Fe I	34	2100.146	1	2105.82	2	Ni I?	43	2105.85	48
2100.38	1	Fe I		2100.393	43	2106.06	3	Mn I		2106.052	4
2100.64	1	Cr II? Fe I	16 28	2100.61 2100.612	UV 1	2106.26	3	Fe I	31	2106.259	1
2100.81	4	Fe I	33	2100.798	1	2106.39	5	Fe I	33	2106.395	1
2101.02	1	Fe II	250	2101.008	23	2106.54	1				
2101.32	1					2106.70	2	Fe I		2106.692	1
2101.46	1	Fe I		2101.475	1	2106.82	3	Co I	90	2106.82	UV
2101.65	1					2107.16	4	Fe I		2107.144	1
2102.34	5	Fe I	33	2102.355	1	2107.27	2				
2102.58	2	Al I		2102.558	14	2107.53	3	Al I Fe II	250	2107.526 2107.555	14 23
2102.81	1	Al I		2102.806	14	2107.80	3	Fe II	80	2107.794	23
2102.91	2	Fe I	34	2102.910	1	2107.94	3	Cr II Ni II	16 60	2107.92 2107.954	UV 52

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2108.16	3	Fe I	28	2108.136	1	2112.08	3	Cu II	55	2112.100	25
		Fe II	81	2108.137	23						
		Fe I		2108.193	1	2112.18	2	Cr II	15	2112.16	UV
2108.30	2	Fe I	34	2108.303	1	2112.43	1	Co I	83	2112.40	UV
								Ni II	60	2112.450	52
2108.60	6	Fe I		2108.578	1						
		Al I		2108.596	14	2112.58	2				
		Al I		2108.626	15						
2108.70	5	Fe I		2108.720	1	2112.75	5	Ca II	9	2112.757	12
2108.96	5	Fe II	227	2108.942	UV	2112.97	6 W	Fe I	33	2112.969	1
		Fe I	33	2108.961	1						
2109.08	1	Fe II	227	2109.097	UV	2113.12	6	Fe I	81	2113.087	1
		Fe II	250	2109.097	23			Ca II	9	2113.146	12
2109.20	1	Fe I		2109.204	1	2113.54	3	Co I	87	2113.53	UV
								Ni II	60	2113.579	52
2109.29	1					2113.83	2	Fe II	272	2113.857	23
2109.44	1					2113.95	3	Mn II		2113.964	19
2109.60	3	Mn I		2109.585	4	2114.17	1				
2109.76	2	Ni I	17	2109.79	UV	2114.43	5	Ni I	64	2114.43	UV
2110.00	6 W	Fe I		2109.893	1	2114.63	7 W	Fe I	33	2114.600	1
		Al I		2109.998	15			Si I	4	2114.631	37
2110.23	3	Fe II	290	2110.243	23	2114.98	5	Al I		2114.991	15
		Fe I	31	2110.245	1	2115.18	3	Fe I	33	2115.170	1
2110.44	3	Fe II		2110.436	23	2115.34	2	Co I	80	2115.35	UV
2110.71	3	Fe II	80	2110.724	23	2115.68	1 h	Fe II	250	2115.699	23
		Fe II	108	2110.734	23						
2110.91	1					2116.04	3				
2110.98	1	Cr II	26	2110.98	UV	2116.32	1				
2111.23	3	Fe I	31	2111.232	1	2116.45	2				
2111.42	3	Fe I		2111.436	1	2116.54	2	Al I		2116.542	14
		Co II	2	2111.446	18	2116.69	1				
2111.63	2	Fe I		2111.637	1	2116.76	1				
2111.70	4	Ni I	17	2111.73	UV	2116.86	3	Co I	24	2116.83	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2116.92	2	Fe I	81	2116.914	1	2121.91	6				
2117.01	3	Fe II Ti I?	213	2116.993 2117.021	23 58	2122.20	5	Fe I	26	2122.178	1
2117.31	2					2122.43	3	Fe II		2122.454	23
2117.47	5	-Vd II	8	2117.482	UV	2122.80	2	Fe I		2122.799	1
2117.70	1	Co I	86	2117.68	UV	2122.96	3	Fe I Cu II Si I	54 49	2122.952 2122.980 2122.994	1 25 37
2117.79	2	Fe I		2117.792	1	2123.12	1	Fe I		2123.124	1
2117.94	3	Co II	2	2117.955	18	2123.36	4	Vd II Al I	8	2123.340 2123.362	UV 14
2118.14	1					2124.12	8 W	Si I	48	2124.122	37
2118.21	4	Fe II	120	2118.195	23	2124.80	3	Ni I	63	2124.80	UV
2118.32	5 w	Al I		2118.332	15	2124.95	3	Fe I		2124.953	1
2118.54	2 w	Co I	80	2118.51	UV	2125.11	3 d	Co I Ni II	84 14	2125.10 2125.122	UV 52
2118.66	3	Ca I		2118.672	45	2125.42	2	Fe II		2125.426	23
2119.04	4	Fe II	120	2119.050	23	2125.61	3	Ni I	16	2125.62	UV
2119.14	4	Fe I	28	2119.136	1	2125.91	4 w	Ni II	13	2125.914	52
2119.18	1	Co I	85	2119.192	UV	2126.06	3 w	Cu II	14	2126.045	25
2119.28	4	Fe I		2119.305	1	2126.19	3	Fe I	27	2126.209	1
2119.64	3	Mn II?		2119.65	19	2126.50	1				
2119.88	2	Co I	80	2119.91	UV	2126.60	3	Fe I Au I	2	2126.607 2126.63	1 UV
2120.55	1					2126.81	3	Fe I Ni II	29	2126.817 2126.838	1 52
2120.75	5 w	Fe I		2120.775	1	2126.93	3	Vd II	8	2126.932	UV
2121.07	4	-Fe II	80	2121.099	23	2127.00	2	Fe II		2127.012	23
2121.19	5 w	Si I	4	2121.194	37	2127.12	1	Co I	8	2127.14	UV
2121.38	5	Ni I	38	2121.40	UV	2127.27	3	Al I		2127.302	14
2121.57	4	Al I		2121.576	14						
2121.64	1										

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2127.49	4	Fe I	28	2127.478	1	2131.35	2	Fe II		2131.359	23
2127.58	2	Fe II	272	2127.602	38	2131.50	4	Ca II	3	2131.505	12
2127.77	2	Ni II	41	2127.777	52	2131.82	2	Vd II	8	2131.85	UV
2127.88	5	Fe I		2127.863	1	2132.01	4	Fe I	25	2132.014	1
2127.95	1	Fe II	29	2127.973	23	2132.30	3	Ca II	3	2132.304	12
2128.25	2	Vd II	8	2128.241	UV	2132.40	3	Cr II	24	2132.38	UV
2128.39	3	Ni I	19	2128.41	UV			Al I		2132.388	14
2128.58	4	Ni II	15	2128.583	52	2132.55	5	Fe I		2132.532	1
2128.75	4	Ca II	3	2128.750	12			Fe II	272	2132.540	23
2128.93	1					2132.64	4	Cr II	24	2132.62	UV
2129.12	4d							Cr II	24	2132.62	UV
2129.47	4	Vd II	7	2129.477	UV	2132.73	3	Cr II	24	2132.71	UV
2129.66	5W	Al I		2129.663	14			Co I	23	2132.76	UV
2129.89	4	Cr II	24	2129.89	UV	2132.91	2	Cr II	24	2132.93	UV
2129.96	4	Ni I	37	2129.96	UV	2133.00	3	Cr II	24	2133.03	UV
2130.15	3					2133.30	3	Fe I	81	2133.310	1
2130.24	4W	Cr II	14	2130.22	UV	2133.46	4	Co II	2	2133.466	57
		Cr II	24	2130.22	UV			ICr II	23	2133.49	UV
		Cr II	79	2130.22	UV	2133.81	2	Cr II	23	2133.81	UV
		Fe II	80	2130.254	23	2133.97	2	Fe II		2133.956	23
2130.45	3	Fe I	83	2130.409	1			IFe II	213	2134.011	23
		Fe I		2130.443	1	2134.11	5w	Vd II	7	2134.12	UV
2130.57	3	Fe II	249	2130.550	23	2134.20		Cr II	23	2134.20	UV
2130.77	2	Cu I?	21	2130.760	32	2134.27	2	Ni II	31	2134.289	52
		Ni I		2130.78	UV	2134.46	3				
2130.98	5	Fe I		2130.964	1	2134.57	4W	ICr II	23	2134.52	UV
2131.07	2	Ni II—	31	2131.046	52			Fe II	212	2134.575	23
		Ni II		2131.099	52	2134.62		Cr II	23	2134.62	UV
2131.25	4	Ni II	14	2131.265	52						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2134.74	4	Al I Al I		2134.733 2134.760	14 38	2139.31	3	Fe II Cr II	80 14	2139.318 2139.33	23 UV
2134.90	3	Cr II Ni I	23 37	2134.88 2134.93	UV UV	2139.55	3	Cr II	14	2139.54	UV
2135.08	2	Cr II Fe I	23	2135.09 2135.095	UV 1	2139.69	6w	Fe II Fe I Fe I	6 24 27	2139.640 2139.701 2139.701	23 1 1
2135.32	5D	Fe II Fe I Ni I Cr II		2135.275 2135.327 2135.34 2135.34	23 1 UV UV	2139.80	3	Vd II	7	2139.798	UV
2135.45	5D	Cr II— IP I	23 4	2135.42 2135.465	UV 55	2140.05	4	Vd II	7	2140.064	UV
2135.70	3	Ti II?		2135.73	47	2140.14	3	Fe II	120	2140.168	23
2135.95	5	Cu II	14	2135.981‡	25	2140.52	3	Cr II	14	2140.50	UV
2136.16	5	P I	4	2136.182	55	2140.68	2				
2136.44	5D	Fe I Co II Fe II		2136.418 2136.459 2136.511	1 18 23	2140.86					
2136.69	1H					2141.07	4	Fe I	26	2141.086	1
2136.92	3	Fe I		2136.937	1	2141.46	4	Fe I		2141.467	1
2137.04	1					2141.73	5	Fe I	25	2141.718	7
2137.27	3	Vd II	7	2137.31	UV	2142.00	4	Vd II	7	2141.973	UV
2137.49	1					2142.14	3	Fe I	30	2142.141	UV
2137.75	5	Fe II	6	2137.748	23	2142.32	3				
2138.02	5	Fe I Fe II		2137.997 2138.049	1 23	2142.39	3	Al I Fe II?		2142.402 2142.416	14 23
2138.14	2	Vd II	7	2138.17	UV	2142.49	3	Fe I?		2142.51	51
2138.58	8W	I Zn I I Ni II Fe I	1 13 24	2138.573‡ 2138.582 2138.585	2 52 1	2142.56	3	Fe I		2142.575	29
2139.06	3	Fe I		2139.062	1	2142.76	1				
2139.19	2w					2142.83	5	Fe I		2142.820	29
						2143.01	5	Vd II	7	2143.038	UV
						2143.37	3	Fe I		2143.369	29
						2143.55	3	Fe I		2143.545	43

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2143.72	1					2147.72	2	Fe II	213	2147.704	23
2143.89	5	Fe I		2143.892	29	2147.79	3	Ni I	37	2147.80	UV
2144.07	2	Cr II	14	2144.05	UV	2147.93	3	Si I	94	2147.911	37
2144.22	2	Pt I	2	2144.22	UV	2148.06	1	Cr I?		2148.02	28
		Pt II	12	2144.244	UV	2148.24	2				
2144.39	3	Cd II	1	2144.408†	UV	2148.40	3	Fe I	29	2148.394	UV
2144.44	4					2148.50	3	Fe I?		2148.53	51
2144.57	4	Fe I	81	2144.576	UV	2148.60	3	Fe II	6	2148.606	23
2144.71	2					2148.85	1				
2144.98	1	Fe I	81	2144.947	43	2148.99	3	Cu II	14	2148.984	25
2145.20	4	Fe I	27	2145.189	7	2149.15	5	IP I	4	2149.145	55
2145.56	4w	Al I		2145.555	14			Fe I	80	2149.170	UV
2145.87	2h	Fe I?		2145.86	51	2149.42	2	Fe I	81	2149.416	UV
2146.04	4	Fe II	6	2146.046	23	2149.62	3	Fe I		2149.620	29
2146.28	3	Co I	23	2146.26	UV	2150.17	4	Fe I	25	2150.184	7
2146.37	2	Fe II		2146.367	23	2150.44	4	Si I	95	2150.46	37
2146.47	1	Fe I	83	2146.478	43	2150.62	4	Fe II	135	2150.621	23
2146.61	1	Fe II		2146.609	23	2150.75	7W	Al I		2150.699	14
2146.72	3	Fe I	27	2146.710	UV			Al I		2150.728	38
2146.81	3	Fe I		2146.806	29			Cr II	37	2150.74	UV
								Cr II	37	2150.74	UV
2146.99	2							Fe II	248	2150.764	23
2147.04	3	Fe I		2147.045	7	2150.99	1	Fe I		2151.005	29
2147.16	2	Cr II	14	2147.19	UV	2151.10	3	Fe II	106	2151.090	23
								Fe I	24	2151.099	UV
2147.23	2							Fe I	25	2151.099	UV
2147.40	2	Co II	2	2147.375	57	2151.23	2				
2147.56	3	Al I		2147.560	14	2151.66	5	Fe I		2151.695	7
						2151.88	4	Fe I?		2151.90	51

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2152.15	5	Co I	78	2152.15	UV	2156.67	2	Co II	11	2156.652	57
2152.21		Ni I	38	2152.23	UV			Co II	11	2156.689	18
2152.37	3	Fe II	106	2152.368	23	2156.81	2	Ti II	19	2156.804	56
2152.55	2	Cr I	44	2152.57	UV	2156.94	2	Co II	11	2156.937	18
2152.83	3	Sr II	3	2152.84	UV	2157.23?	2W				
2152.97	6	P I	9	2152.940	33	2157.43	2				
		Fe I	27	2153.006	7	2157.80	4	Fe I	24	2157.794	7
2153.58	2	Fe II		2153.606	23			Ni I	36	2157.83	UV
2153.89	2	Fe II	6	2153.904	23	2157.96	1	Fe II		2157.958	23
2154.07	4	P I	9	2154.080	55	2158.30	3	Ti II	19	2158.295	56
		P I	9	2154.080	55			Ni I	36	2158.31	UV
		Co I	24	2154.08	UV	2158.50	3D	Fe I	77	2158.474	7
2154.34	4							Fe II	89	2158.521	23
								Si I		2158.526	37
2154.44	5	Cr I	44	2154.44	28	2158.63	2	Fe I	23	2158.630	7
		Fe I	77	2154.458	UV	2158.73	3	Fe I		2158.734	7
2154.57	1	Ti II?		2154.58	38			Ni II	13	2158.741	52
2154.70	3	Ti II	19	2154.709	56	2158.90	3	Fe I	24	2158.920	7
2154.87	2					2158.99	2	Fe I		2158.993	29
2155.00	3	Fe I	25	2155.020	7	2159.08	2	Ti II	19	2159.083	56
2155.12	4	Fe I?		2155.114	29	2159.15	5	Fe II	6	2159.160	23
2155.24	5	Fe I	27	2155.238	UV	2159.42	4	Fe I	27	2159.431	7
		Fe I	78	2155.238	UV	2159.50	2	Ti II	19	2159.513	56
2155.61	4	Ti II	19	2155.596	56	2159.65	3	Fe I		2159.638	7
2155.81	4	Fe I		2155.816	29			Fe I	24	2159.658	7
2155.97	1							Fe II		2159.667	23
2156.22	2	Cr II	133	2156.22	UV	2159.89	5	Fe I	24	2159.924	7
2156.43	3	Fe I		2156.432	29	2160.22	4	Fe I	82	2160.236	UV
2156.47	3	Fe I	77	2156.504	29	2160.45	4	Fe II	185	2160.471	UV
						2160.78	2	Fe II		2160.795	23

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2161.03	3	Ni I	37	2161.04	UV	2165.55	6d	INi II Fe II	13 185	2165.553 2165.556	52 23
2161.17	3	Fe II	213	2161.16	23	2165.84	3	Fe I		2165.861	UV
2161.23	3	Ni II Fe II	14 370	2161.217 2161.313	52 UV	2165.96	2	Sr II Fe I	3	2165.93 2165.982	UV 29
2161.58	4	Fe I Fe II	27 119	2161.579 2161.582	7 UV	2166.19	5D	Ni I— II Fe II	37 212	2166.15 2166.225	UV 23
2161.67	1	Cr II	133	2161.66	UV	2166.60	6	Fe I Si I		2166.586 2166.599	43 37
2162.02	3	Fe II	90	2162.023	23	2166.77	7W	Fe I	21	2166.773	7
2162.24	4d	Fe I Cr I		2162.248 2162.25	7 28	2167.26	2	Fe I	78	2167.271	29
2162.45	3H	Cr I	44	2162.47	UV	2167.40	4	Fe II	119	2167.425	23
2162.67	3	Ti II	19	2162.68	UV	2167.52	2				
2162.84	2	Fe II	89	2162.846	23	2167.70	4	Si I	92	2167.700	37
2163.04	2	Co I	26	2163.02	UV	2167.86	3	Fe II	213	2167.879	23
2163.19	1	Ni II		2163.208	52	2168.04	4	Fe I		2168.057	43
2163.37	4	Fe I		2163.368	UV	2168.27	4	Fe II	6	2168.290	23
2163.58	2	Co I	23	2163.56	UV	2168.36	4				
2163.78	3	Si I	93	2163.773	37	2168.71	5	Co I Fe II	23 134	2168.70 2168.720	UV 23
2163.87	4	Fe I	24	2163.860	UV	2168.80	6W	Al I	9	2168.826	14
2163.97	2					2169.11	6	Ni II	13	2169.096	52
2164.36	5	Fe II	79	2164.336	23	2169.59	5W	Cu I—	26	2169.586	32
2164.55	6	IFe I Al I	24	2164.549 2164.577	7 14	2169.86	2	Al I Fe II		2169.843 2169.864	14 23
2164.63	1	Fe II	213	2164.615	23	2169.94	3	Fe II Ni II	370	2169.950 2169.955	UV 52
2164.88	1					2170.16	5	Fe II		2170.176	23
2165.09	3	Cu I	4	2165.093	UV	2170.56	6	Co I Fe I	23 77	2170.55 2170.554	UV 29
2165.20	2	Fe II?	151	2165.232	23						
2165.27	2										

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2170.72	3	Cr II	36	2170.71	UV	2174.48	3	Ni I	36	2174.480	UV
2171.08	4	Cr II	36	2171.06	UV	2174.59	} 6W	Co I	19	2174.589	UV
		Cr II	36	2171.06	UV	2174.68		INi II	14	2174.666	52
2171.18	2	Cr II	36	2171.18	UV	2174.85	2	Fe II	135	2174.849	23
2171.28	7W	Fe I	24	2171.297	7	2175.15	6	Ni II	13	2175.147	52
2171.55	3	Cr II	36	2171.55	UV	2175.47	6	Fe II	90	2175.451	23
		Cr II	36	2171.55	UV						
2171.82	2	Cu I	26	2171.835	32	2175.70	1				
2172.03	2	Fe I		2172.037	29	2175.82	1	Sb I	1	2175.81	UV
		Fe II	372	2172.044	23	2175.92	4				
2172.13	4	Fe I	23	2172.144	7	2176.01	4	Fe I?		2176.02	51
2172.19	3	Co I	77	2172.18	UV	2176.22	2	Fe I		2176.216	29
		Fe I		2172.221	29						
2172.33	2	Fe I	82	2172.332	29	2176.31	2	Fe II		2176.322	23
2172.57	5	Fe I	23	2172.585	7	2176.38	2	Fe I	79	2176.396	UV
2172.68	3	Fe I	78	2172.658	29	2176.50	2	Co I	120	2176.48	UV
		Fe II	372	2172.679	UV			Fe II		2176.501	23
2172.91	2	Co II?	10	2172.875	57	2176.66	3d	Fe I		2176.670	29
2172.97	4	Fe II	134	2172.980	23	2176.85	5	Fe I	23	2176.840	7
2173.22	5	Fe I	24	2173.214	7	2177.02	4	Vd I— IFe II	46 106	2177.00 2177.032	UV 23
2173.34	2	Co II	2	2173.326	18	2177.09	3	Ni II	40	2177.086	52
		Co II	10	2173.326	18						
2173.47	1	Fe II		2173.449	23	2177.36	} 6W	Ni II	40	2177.361	52
2173.54	3	Ni I	59	2173.535	UV	2177.42		ISi I	91	2177.432	37
2173.70	3	Fe II	79	2173.691	23	2177.53	3	Fe II	247	2177.542	23
2173.85	3	Co I	23	2173.82	UV	2177.71	4h	Fe I	80	2177.695	7
2174.10	6w	Al I	9	2174.071	14	2178.09	8W	Fe I	21	2178.073	UV
		Al I	9	2174.113	14			Fe I	22	2178.118	7
2174.29	1					2178.56	3h	Fe I	77	2178.546	43
								Co I		2178.59	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2178.81	4	Fe I		2178.797	29	2182.86	2				
2178.95	5	Cu I	3	2178.944	UV	2182.96	1				
2179.36	5	Ni II	40	2179.352	52	2183.23	3	Ni II		2183.217	52
2179.44	6	Cu II	14	2179.410	25	2183.38	4	Ni I		2183.37	48
		Ni II	12	2179.453	52	2183.48	5	Fe I	23	2183.465	UV
2179.55	2	Fe II	119	2179.554	23	2183.58	2	Fe II	89	2183.571	38
2179.84	2	Fe II	134	2179.851	23	2183.81	4	Fe II	247	2183.789	23
2179.99	3	Ni II	30	2179.990	52			Fe II		2183.835	23
2180.05	3	Co I	20	2180.060	UV	2183.90	4	Ni I	62	2183.91	UV
2180.24	4	Fe II	370	2180.260	23	2183.97	4	Fe I?		2183.979	51
2180.47	4	Ni II	40	2180.473	52	2184.17	3				
2180.60	2	Co II	23	2180.604	18	2184.30	1	Co I	17	2184.31	UV
2180.69	1					2184.46	3	Fe I		2184.46	29
2180.86	5	Fe I	23	2180.869	7	2184.61	6w	Ni II	13	2184.605	52
2180.98	1	Al I		2180.996	14	2184.69	2	Fe II	79	2184.696	23
2181.13	4	Co I	120	2181.12	UV	2184.91	2	Mn I?		2184.912	4
		Fe I	20	2181.133	UV			Co I	118	2184.92	UV
2181.38	2h	Fe II		2181.372	23	2185.09	2				
2181.49	3w					2185.21	3	Fe I	77	2185.216	29
2181.65	4					2185.34	1				
2181.71	5	Co II	11	2181.716	57	2185.49	5	Ni II	40	2185.504	52
		II Cu I	3	2181.720	UV	2185.59	2	Fe II	271	2185.588	23
2181.99	2	Co II	23	2181.989	18	2185.71	1				
2182.23	2h	Vd I	46	2182.22	UV	2186.01	3	Co I	81	2186.030	UV
2182.38	5	Ni I	16	2182.38	UV	2186.13	1				
2182.60	4	Co I	23	2182.59	UV	2186.25	5	Fe I	20	2186.250	7
2182.77	3	Mn I		2182.773	4	2186.50	8	Fe I	21	2186.486	7

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2186.77	3	Fe I Co I	73	2186.760 2186.777	29 UV	2190.97	4	Ni II	29	2190.967	52
2186.89	7	Fe I	22	2186.892	7	2191.21	5	Fe I Ni I	22 61	2191.204 2191.21	7 UV
2187.20	7	Fe I	21	2187.195	UV	2191.39	3	Mn I		2191.413	4
2187.28	3	Co I Co I	75 121	2187.28 2187.28	UV UV	2191.84	8 W	Fe I	21	2191.839	7
2187.44	2	Fe II	271	2187.441	23	2192.09	3	Ni II		2192.090	52
2187.51	2					2192.26	} 5D	Cu II	14	2192.268	25
2187.60	3	Ni I	16	2187.60	UV	2192.33		Ni II	40	2192.341	52
2187.68	4	Fe II	89	2187.684	23	2192.52	5	Co II	22	2192.505	18
2187.87	5	Fe II	135	2187.868	23	2192.82	4	Fe I		2192.819	29
2188.05	5	Ni II	12	2188.045	52	2193.27	2	Cr II	151	2193.30	UV
2188.78	5h	-Fe II?		2188.820	38	2193.41	4	Fe I		2193.411	UV
2189.03	5	Co II Fe II	11	2188.990 2189.033	18 23	2193.59	6	Fe I Co II	114 22	2193.564 2193.603	UV 18
2189.20	4	Fe I	114	2189.183	UV	2193.66	2	Fe II		2193.668	38
2189.41	6	Fe I	78	2189.393	UV	2193.76	1	Mn I		2193.762	4
2189.51	4	Ni II Fe I		2189.498 2189.514	52 29	2194.06	2	Fe I	19	2194.076	43
2189.63	3	Cu II	53	2189.630	25	2194.17	2				
2189.70	2	Fe I		2189.720	29	2194.49	3d				
2190.23	6w	Ni I	36	2190.223	UV	2194.82	2	Fe I	76	2194.839	43
2190.41	1					2194.95	1				
2190.53	1	Ni II		2190.557	52	2195.09	2				
2190.68	4	Co II	22	2190.675	18	2195.32	1				
2190.76	5	Fe I?		2190.77	51	2195.46	2				
2190.88	4	Fe I		2190.879	29	2195.57	2				
						2196.04	7 W	Fe I	21	2196.043	7
						2196.30	1				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2196.45	3	Co I	19	2196.458	UV	2201.12	5	Fe I	20	2201.117	UV
2196.61	1					2201.25	2	Co I	76	2201.23	UV
2196.82	2D	Cr II	151	2196.84	UV	2201.41	6	Ni II	13	2201.409	52
2196.98	2	Fe I?		2196.962	43	2201.57	6	Ni I Fe II	60 367	2201.59 2201.595	UV UV
2197.06	2					2202.04	2				
2197.15	1					2202.17	2	Fe II	271	2202.163	38
2197.24	5	Fe I Fe II	20 226	2197.230 2197.263	UV 23	2202.29	1				
2197.35	6	Ni I	36	2197.347	UV	2202.40	1				
2197.67	3w					2202.49	2h				
2197.79	5	Ca II	8	2197.787	12	2202.70	3	Mg II		2202.681	38
2198.31	5	Co II Cr I	10 43	2198.266 2198.32	18 UV	2202.79	1				
2198.43	4					2202.91	2	Co II	1	2202.928	UV
2198.71	6	Ge I	11	2198.714	25	2202.98	4	Co II		2202.951	18
2198.97	2	Fe II?	151	2198.964	38	2203.33	2	Fe I?		2203.328	43
2199.18	5	Al I	8	2199.183	14	2203.42	4	Fe II—	406	2203.420	UV
2199.42	1					2203.54	4				
2199.59	5	Cu I	23	2199.586	32	2203.88	4	—Cr II	13	2203.89	UV
2199.74	6	Cu I	23	2199.750	32	2204.09	5				
2200.00	2					2204.66	7W	Al I Al I	8 7	2204.619 2204.668	14 14
2200.09	2	Fe I		2200.084	29	2204.80	2	Co I	74	2204.796	UV
2200.20	2					2205.05	6	Co II	22	2205.073	18
2200.38	7W	Fe I Co II	21 11	2200.390 2200.410	7 18	2205.21	2w	Cr I	43	2205.20	UV
2200.49	3	Fe I		2200.494	29	2205.56	6	Co II Ni II	22	2205.547 2205.548	18 52
2200.72	7W	Fe I Ca I	21 7	2200.724 2200.728	7 45	2205.78	1				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2205.88	6					2210.24	2	Cu II	52	2210.268	25
2206.08	3	Fe		2206.083	7	2210.39	4	Ni II	13	2210.382	52
2206.19	6	Co II	22	2206.182	18	2210.70	2	Fe I	18	2210.689	7
2206.33	1	Zr II?	17	2206.31	UV	2210.89	6W	Si I	3	2210.894	37
2206.44	3	Fe I		2206.444	29	2210.97	4	Fe II	118	2210.952	UV
2206.59	4	Fe II	134	2206.582	UV			Fe II	134	2210.952	UV
2206.71	7W	Ni II	13	2206.715	52	2211.10	3	Ni II	52	2211.097	52
2207.07	3	Fe I	19	2207.068	7			Fe II	168	2211.112	UV
2207.18	1	Cr II	31	2207.18	UV			Fe II	289	2211.122	UV
2207.73	3	Co I	22	2207.71	UV	2211.25	3w	Fe I	20	2211.234	UV
		Ni I	9	2207.74	48			Fe II	305	2211.243	UV
2207.85	3	Co I	22	2207.853	UV	2211.41	4	Co II	10	2211.430	18
2207.90	3	Co II	23	2207.914	18	2211.74	6w	Si I	3	2211.744	37
2207.98	9W	Si I	3	2207.978	37	2212.16	5	Ni I	15	2212.149	UV
2208.28	1	Fe I		2208.280	29	2212.34	3	Co I	18	2212.35	UV
2208.41	1	Fe II	367	2208.411	23	2212.44	3				
2208.51	1	Co I	20	2208.508	UV	2212.59	3				
2208.62	4	Ca II	8	2208.611	12	2212.86	3w				
2208.73	2	Fe I	20	2208.714	29	2213.18	4	Ni II	30	2213.196	52
2208.80	4	Mn I		2208.806	4	2213.48	2				
2209.02	5	Fe II	366	2209.029	23	2213.66	7W	Fe II	168	2213.679	UV
2209.38	2	Cr II		2209.37	27	2213.86	7	Co I	21	2213.84	UV
2209.53	2	Fe I		2209.541	43			Co I	75	2213.84	UV
2209.74	2	Fe II		2209.723	10			Mn I		2213.855	4
2210.05	6	Al I	7	2210.060	14	2214.02	2	Fe II	368	2214.041	23
2210.11	5	Al I	7	2210.130	14	2214.11	2	Mn I?		2214.10	4
						2214.27	4w	Fe I	114	2214.257	43
						2214.40	4	Fe II		2214.405	10
						2214.49	3				
						2214.58	4	Cu I	22	2214.582	32

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2214.78	5	Co II	11	2214.793	18	2220.10	4	Co II	22	2220.110	18
2215.06	3	Fe II	369	2215.077	23	2220.21	1	Vd II	28	2220.214	UV
2215.23	2	Fe I?		2215.230	43	2220.29	1				
2215.30?	1	Cr II	12	2215.30	UV	2220.39	6 W	Fe II Ni II	118 28	2220.388 2220.402	UV 52
2215.44	3					2220.53	1				
2215.55	2					2220.63	1				
2215.65	5	Cu I	22	2215.654	UV	2220.91	4	Fe I	19	2220.912	UV
2215.87	1					2221.16	5	Fe II	168	2221.160	UV
2216.00	1	Fe II		2216.009	38	2221.32	3	Fe I		2221.34	51
2216.47	7 W	Ni II	12	2216.482±	52	2221.44	2	Ti I?		2221.474	58
2216.68	7 W	Si I	3	2216.669	37	2221.82	5	Mn I		2221.837	4
2217.05	2	Fe II	168	2217.048	UV	2221.94	4	Ni I	15	2221.939	UV
2217.28	2	Co II	10	2217.290	18	2222.07	3	Fe I	114	2222.059	29
2217.58	3	Fe I	114	2217.578	UV	2222.16	2				
2217.75	5	Fe I Ni I	20 33	2217.744 2217.77	UV UV	2222.24	1				
2217.87	1	Cr II?	51	2217.89	UV	2222.36	1				
2218.06	6 W	Si I— Cu II	3 13	2218.057 2218.108	37 25	2222.44	3	Fe II	168	2222.446	UV
2218.40	3	Ti I—	18	2218.382	58	2222.60	2	P I Pt I	3 9	2222.579 2222.60	55 UV
2218.81	3	Co I	73	2218.81	UV	2222.66	3	Fe II	369	2222.667	23
2218.91	6	Si I	3	2218.915	37	2222.76	3 H	Fe I	113	2222.75	UV
2219.14	2	Co I	16	2219.16	UV	2222.96	6 W	Ni II	12	2222.957	52
2219.27	1					2223.19	2 h	Ti I	18	2223.199	58
2219.42	3					2223.35	3	P I	3	2223.359	55
2219.70	3	Fe II		2219.712	10	2223.47	6	Fe II	168	2223.481	UV
2219.89	4	Fe II	168	2219.889	UV	2223.76	3	Fe I		2223.747	29

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2223.85	2h	Fe II	368	2223.866	UV	2227.48	2	Fe II	369	2227.469	UV
2224.06	1	Co II		2224.085	18	2227.61	3	Fe II	168	2227.597	UV
2224.14	1					2227.76	3	Cu I	21	2227.771	32
2224.35	5	Ni II	21	2224.355	52	2227.83	3	Co I	16	2227.853	UV
2224.47	6					2228.16	6	Fe I	18	2228.172	7
2224.86	7W	Ni II	12	2224.864	52	2228.22	3	Cr I	42	2228.22	28
2225.10	2	Ti I?		2225.128	58	2228.31	1	Cr II	283	2228.34	UV
2225.33	6	Co I	19	2225.339	UV	2228.49	2	Fe I	19	2228.489	UV
2225.40	1	Ni I	16	2225.35	UV	2228.69	2w				
2225.46	1h	Mo I	2	2225.437	UV	2228.80	2	Fe II Co I	366 19	2228.761 2228.80	UV UV
2225.58	1h					2228.87	2h	Ti II Cu II		2228.85 2228.868	47 25
2225.69	4	Cu I	2	2225.697	UV	2229.06	3	Fe I	18	2229.073	7
2225.75	1					2229.22	3	Ti II		2229.25	47
2225.86	5	Co I	120	2225.84	UV	2229.42	3w				
2226.07	1					2229.63	3	Fe I		2229.632	43
2226.24	1	Cr II	35	2226.27	UV	2229.72	3	Co I	68	2229.734	UV
2226.31	7W	Ni II	12	2226.329	52	2229.97	2	Vd II	28	2229.985	UV
2226.41	1					2230.07	6w	-Cu I	21	2230.084	UV
2226.46	1	Cr II Cr II	12	2226.47 2226.47	UV UV	2230.19	2				
2226.55	1h					2230.36	1	Zr II?	59	2230.38	UV
2226.78	1H	Ti I	18	2226.798	58	2230.44	3				
2226.86	1	Fe I?		2226.85	51	2230.63	1				
2226.95	1	Fe II		2226.962	38	2230.93	6	Ti II Ni I		2230.95 2230.955	47 UV
2227.15	4	Ti II		2227.157	56	2231.09	3	Fe I	112	2231.090	29
2227.36	3	Fe II	168	2227.378	38						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2231.20	5	Fe I	18	2231.213	7	2235.63	1				
2231.32	2					2235.73	3	P I	3	2235.732	55
2231.46	3	Cr II	283	2231.45	UV	2235.79	1				
2231.51	3	Fe II	368	2231.505	23	2235.92	2				
2231.64	3					2236.06	1w	Ni II?	53	2236.063	52
2231.75	2	Co I?	74	2231.749	50	2236.29	6w	Cu I—	24	2236.278	UV
2232.07	5	Co II	10	2232.075	18	2236.44	3				
2232.24	2h					2236.53	1w				
2232.41	2	Fe II		2232.406	38	2236.68	6	Fe II	4	2236.680	UV
2232.47	3	Co I	20	2232.460	UV	2236.80	5	Co I	19	2236.796	UV
2232.70	2					2236.95	1w				
2232.76	2	Fe II?		2232.732	38	2237.16	5	Co I Co I	70 119	2237.125 2237.125	UV UV
2232.89	4					2237.22	2	Vd I?	39	2237.228	UV
2233.09	3					2237.57	4	Fe II	365	2237.577	UV
2233.20	1					2237.73	4				
2233.76	5	Fe II Co I	4 21	2233.753 2233.759	38 UV	2237.82	5	Fe I	114	2237.814	UV
2233.91	5w	—Fe II	118	2233.917	UV	2237.91	3	Fe II	334	2237.894	23
2234.18	4					2238.15	3				
2234.44	5W	Fe I—	114	2234.432	UV	2238.25	4	Fe I	18	2238.259	UV
2234.55	3					2238.44	4	Cu I	25	2238.458	32
2234.70	5	Co I	67	2234.710	UV	2238.55	3				
2234.84	4	Fe I?		2234.87	51	2238.64	2	Fe II		2238.629	23
2234.95	3	P I		2234.958	55	2238.73	2	Ti I	17	2238.750	58
2235.25	3					2238.90	2d				
2235.38	1					2239.02	4	Fe II	365	2239.047	23
2235.52	3	Fe II		2235.514	10						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2239.15	2					2243.04	4	Fe I— Yt II	75 1	2243.022 2243.06	43 UV
2239.21	3					2243.25	4d	Co I Cr II	19 77	2243.254 2243.28	UV UV
2239.51	3					2243.39	4				
2239.64	2h	Fe II	334	2239.638	23	2243.59	5	Fe II ICr II	118 77	2243.578 2243.62	UV UV
2239.78	1	Fe II		2239.814	10	2243.73	} 3W				
2239.98	2					2243.81					
2240.27	4					2243.91	5	Fe I	16	2243.911	UV
2240.33	6	Fe II	4	2240.346	38	2244.05	3				
2240.54	3					2244.14	2				
2240.62	6	Fe I	112	2240.627	UV	2244.21	2	Fe II	365	2244.216	23
2240.90	3					2244.27	4	Cu I	2	2244.265	UV
2241.03	1					2244.45	5	Ni I	34	2244.464	UV
2241.21	3					2244.53	5	Ni I		2244.55	UV
2241.31	2	Cr II	50	2241.30	UV	2244.63	5d	Fe II		2244.600	10
2241.43	5	Fe II	365	2241.426	23	2244.86	4	Cr II	35	2244.83	UV
2241.58	1	Co II		2241.60	57	2244.91	4	Cr II Cr II	35 35	2244.90 2244.90	UV UV
2241.65	4	—Cr II?	50	2241.69	UV	2245.13	5	Co II Fe I	10 75	2245.128 2245.14	18 UV
2241.84	6	Fe I	75	2241.85	UV	2245.33	2h				
2241.93	2					2245.39	1				
2242.10	4d	Fe II—		2242.090	38	2245.50	4	Fe II	365	2245.505	23
2242.35	3	Fe II		2242.333	10	2245.65	4	Fe I	18	2245.653	7
2242.59	5D	P I IFe I Cu II	3 18 52	2242.539 2242.579 2242.618	55 UV 25	2245.76	2				
2242.78	5	Fe I	18	2242.776	43	2246.05	4d	—Fe II		2246.060	38
2242.88	5										

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2246.29	4 <i>W</i>					2250.96	4 <i>w</i>	Fe II	4	2250.937	UV
2246.62	4	Co I	18	2246.599	UV	2251.10	2 <i>h</i>	Co II		2251.12	57
2246.92	4 <i>w</i>	Fe II		2246.912	10	2251.22	3	Fe I		2251.228	43
2247.01	4	Cu II	13	2247.002	25	2251.48	4	Ni I	33	2251.484	UV
2247.25	4	Ni II	30	2247.228	52	2251.58	4	Fe II	5	2251.556	UV
2247.46	3	Fe I	72	2247.461	UV	2251.85	5 <i>D</i>	Fe II Fe I	365 18	2251.830 2251.874	23 7
2247.69	3	Fe II	365	2247.692	23	2252.02	2	Fe I?	113	2252.046	43
2247.90	3	Cr II	49	2247.91	UV	2252.21	1	Nb II?	65	2252.210	UV
2248.12	2	Fe II		2248.102	10	2252.32	1				
2248.19	1					2252.48	1 <i>H</i>				
2248.31	4	Cr II	49	2248.30	UV	2252.73	5	Co I	20	2252.712	UV
2248.54	3	Cr II	49	2248.56	UV	2252.89	3				
2248.68	3	Co II	9	2248.669	18	2253.12	5 <i>w</i>	Fe II	4	2253.119	UV
2248.86	5	Fe I	70	2248.860	7	2253.26	3	Sr I Fe II	9	2253.256 2253.262	16 38
2249.09	4	Fe II Fe II	365 365	2249.063 2249.063	23 23	2253.57	6	Ni I	34	2253.565	UV
2249.18	4	Fe II	365	2249.181	23	2253.68	5	Ni II	29	2253.679	52
2249.26	5					2253.78	5	Co I	64	2253.760	UV
2249.71	2	Fe II		2249.700	38	2253.85	6 <i>d</i>	Ni II	12	2253.848	52
2249.78	4	Cr II	49	2249.78	UV	2254.10	4 <i>w</i>	Fe II Fe II	365	2254.078 2254.109	23 38
2249.92	4	Cr II Cr II	35 35	2249.91 2249.91	UV UV	2254.40	5	Fe II	5	2254.401	UV
2249.98	4	Cr II	49	2249.98	UV	2254.82	5	Ni I	14	2254.810	UV
2250.09	4	Ti II?		2250.084	56	2254.88	4	Fe II		2254.893	10
2250.18	5 <i>w</i>	Fe II	4	2250.171	UV	2254.96	3				
2250.49	1	Co I	117	2250.496	UV	2255.16	5	Fe II		2255.160	10
2250.79	5	Fe I	16	2250.790	7						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2255.24	3					2257.97	4	Cr II	76	2257.96	UV
2255.34	2					2258.02	6	Al I	6	2258.008	14
2255.40	3					2258.09	4	Cr II	76	2258.09	UV
2255.68	4	Fe II	365	2255.691	23	2258.15	5	Ni I	32	2258.145	UV
2255.76	5	Fe II	133	2255.759	UV	2258.36	4 _w	Fe II		2258.372	10
2255.87	6	Fe I Ni I	73 9	2255.865 2255.873	7 UV	2258.81	3 _h	Vd II	16	2258.814	UV
2255.99	5	Fe II Cr II Cr II	4 49 77	2255.979 2256.01 2256.01	UV UV UV	2259.00	2				
2256.06	4	Fe I	75	2256.063	29	2259.06	1	Cr I	41	2259.08	UV
2256.14	4	Ni II	51	2256.137	52	2259.28	5	Fe I	16	2259.279	UV
2256.31	5	Ni I	15	2256.321	38	2259.50	5	Fe I	15	2259.511	7
2256.43	4	Fe II		2256.431	10	2259.58	6	Ni I Si I Fe II Fe II	32 90 334	2259.562 2259.587 2259.589 2259.589	UV 37 23 23
2256.56	4	Co I	67	2256.565	UV	2259.65	4	Fe I	75	2259.644	43
2256.69	3					2260.02	4	Co II		2260.003	18
2256.74	4	Co II Fe I	112	2256.732 2256.750	18 UV	2260.08	4	Fe II	4	2260.078	UV
2256.90	5	Fe II	365	2256.897	UV	2260.24	5	Fe II	5	2260.228	UV
2257.00	1	Vd II	16	2256.984	UV	2260.50	1	Cu I	20	2260.528	UV
2257.08	1	Fe II		2257.096	10	2260.58	5	Fe I	112	2260.594	UV
2257.16	1 _h					2260.73	4	Fe II		2260.750	38
2257.28	1					2260.86	5 _w	Fe II	4	2260.853	UV
2257.38	1 _h					2261.08	3	Vd II	16	2261.084	UV
2257.62	4	Cr II	76	2257.62	UV	2261.18	5	Fe I?		2261.16	51
2257.67	4					2261.44	5	Ni I	13	2261.424	UV
2257.74	4	Cr II	76	2257.76	UV	2261.59	3				
2257.79	5	Fe II	365	2257.788	23	2261.69	5	Si I	47	2261.693	37

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2261.81	1h					2265.76	4	Co II Fe I	9 111	2265.739 2265.763	18 43
2261.99	2	Fe I		2261.998	43	2265.89	3w				
2262.24	3h	Fe II		2262.261	10	2266.00	4h	Fe II	5	2265.991	UV
2262.33	2h	Cr I	41	2262.32	UV	2266.12	4	Fe II		2266.137	10
2262.45	4					2266.24	5	Fe II		2266.241	10
2262.61	3	Co I	14	2262.592	UV	2266.34	5	Ni I	33	2266.348	UV
2262.69	5w	Fe II	5	2262.686	UV	2266.52	3wh	Co II		2266.533	18
2262.91	3H	Ni II	39	2262.898	52	2266.66	2	Cr I	41	2266.66	UV
2263.08	4	Cu I	24	2263.084	32	2266.70	3	Fe II	315	2266.699	UV
2263.24	5	Fe II	246	2263.224	UV	2266.80	2	Co II		2266.797	57
2263.47	5d	Al I Fe I	5 15	2263.463 2263.476	14 UV	2266.91	5	Fe I	70	2266.906	7
2263.58	3					2267.09	5D	Fe I Co I	17 18	2267.085 2267.113	7 UV
2263.74	6	Al I	6	2263.738	14	2267.16	4	Fe I		2267.134	43
2264.02	3	Ti I?		2264.020	58	2267.25	3				
2264.32	3	Fe II		2264.322	38	2267.37	4				
2264.40	5w	Fe I	71	2264.389	7	2267.47	6	Fe I	70	2267.470	7
2264.46	4	Ni II	12	2264.461	52	2267.55	4	Ni I	10	2267.554	UV
2264.60	4	Fe II	246	2264.589	UV	2267.61	4D	II Fe II— Cr I	4 41	2267.584 2267.64	UV UV
2264.72	3	Fe I	75	2264.703	43	2267.92	3w	Ti I?	15	2267.912	58
2264.90	4h	Co I	70	2264.880	UV	2268.16	5d	Cr I Fe II Co I	41 67	2268.13 2268.135 2268.163	28 10 UV
2264.97	3					2268.28	3w				
2265.06	6	Fe I	16	2265.054	7	2268.47	4				
2265.37	3	Ni II	39	2265.345	52	2268.57	5	Fe II	5	2268.562	UV
2265.54	3					2268.74	4	Co I	69	2268.742	UV
2265.60	4	Fe I	73	2265.61	UV						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2268.84	5	Fe II	5	2268.844	UV	2273.62	4d	Fe II Cr I	41	2273.597 2273.62	10 UV
2269.04	5					2273.75	3	Co II?		2273.732	UV
2269.10	5	Al I Fe I	5 16	2269.096 2269.100	14 7	2273.85	5d	-Fe I	73	2273.893	29
2269.22	5	Al I	5	2269.222	14	2274.09	6	Fe I Fe I	16 70	2274.089 2274.089	7 7
2269.33	3					2274.28	4	Fe I		2274.288	29
2270.07	5					2274.51	5	Co I	14	2274.495	UV
2270.21	6	Ni II	12	2270.214	52	2274.66	6	Ni I	9	2274.662	UV
2270.36	4	Fe I	72	2270.368	29	2274.72	5	Ni II	38	2274.724	52
2270.44	5					2275.00	2				
2270.58	3	Fe I	74	2270.575	43	2275.09	2				
2270.68	4	Fe I		2270.675	29	2275.18	6	Fe I	16	2275.192	7
2270.85	6	Fe I	15	2270.862	7	2275.30	3h	Sr I Cr I	8 41	2275.304 2275.31	16 28
2271.24	5d	-Ni I		2271.256	38	2275.45	6	Ca I		2275.462	45
2271.40	3h					2275.60	4	Fe I	111	2275.597	7
2271.78	6	Fe I	70	2271.783	7	2275.68	4	Ni II	39	2275.684	52
2271.94	5	Ni I	35	2271.951	UV	2275.75	3	Fe I		2275.758	29
2272.06	6	Fe I	16	2272.070	7	2275.90	2	Co I	68	2275.884	UV
2272.25	5h	Co II	9	2272.270	18	2276.02	5W	Fe I	14	2276.026	7
2272.60	5	Fe I		2272.610	29	2276.24	4	Cu II	13	2276.258	25
2272.70	5					2276.30	2	Cr I	41	2276.31	28
2272.80	5	Fe I	71	2272.819	7	2276.44	3	Ni II	51	2276.437	52
2273.02	2	Vd II Vd II	15 171	2273.024 2273.024	UV UV	2276.51	4	Co I		2276.523	50
2273.08	3	Sc II	2	2273.10	UV	2276.68	3	Ti I	15	2276.703	58
2273.27	3	Ti I	15	2273.280	58	2276.76	3				
2273.50	3										

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2276.92	2h					2281.03	3				
2277.09	5	Fe I	71	2277.105	7	2281.17	2h				
2277.16	2					2281.24	2	Vd II	123	2281.235	UV
2277.27	4	Ni II	28	2277.282	52	2281.35	2h	SiO	(2-0)	2281.371	30
2277.49	2H					2281.48	2				
2277.68	5w	Fe I Fe I?	70 112	2277.667 2277.716	7 43	2281.62	5d	Vd II Fe I Fe I	26 110 112	2281.601 2281.629 2281.629	UV 29 29
2277.76	4	Ni I		2277.767	UV						
2278.04	2					2281.89	2	Co II		2281.894	18
2278.15	1					2281.99	4	Fe I	17	2281.986	UV
2278.28	5	Si I	89	2278.281	37	2282.16	2h	SiO	(2-0)	2282.173	30
2278.32	5	Ni II	59	2278.318	52	2282.30	1				
2278.63	4d	Fe I	16	2278.614	UV	2282.35	1	Co II?		2282.369	18
2278.77	5w	Ni II	22	2278.770	52	2282.49	3	Fe II		2282.471	10
2279.15	3	Fe I		2279.152	29	2282.66	3				
2279.48	2	Co I	67	2279.480	UV	2282.73	4				
2279.57	4					2282.87	4	Fe I	70	2282.865	7
2279.68	3					2282.94	3				
2279.92	5W	IFe II Fe I	4 16	2279.918 2279.937	UV 7	2283.09	5	Fe I	71	2283.074	7
2280.10	4					2283.31	5W	Fe I	16	2283.305	7
2280.22	5	Fe I	70	2280.216	7	2283.51	4	Co II	9	2283.515	18
2280.32	3	Vd II	123	2280.338	UV	2283.66	5	Fe I	16	2283.655	7
2280.39	4	Fe II		2280.380	38	2283.82	1	SiO	(2-0)	2283.822	30
2280.59	2	SiO	(2-0)	2280.587	30	2283.91	2				
2280.73	3					2283.99	4	Fe II	132	2283.991	UV
2280.95	3	Co II	9	2280.947	18	2284.09	6	Fe I	14	2284.086	7
						2284.23	4	Fe II	105	2284.224	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2284.40	4	Co I	71	2284.375	UV	2288.40	5	Ni I	34	2288.396	UV
2284.66	2	Cr I	41	2284.67	28	2288.54	1	Fe I	71	2288.559	43
2284.75	3	Vd II	45	2284.748	UV	2288.61	3	Fe I	72	2288.608	29
2284.89	6d	ICo I— Vd II	14 26	2284.86 2284.920	UV UV	2288.77	2h	Co I	69	2288.774	UV
2285.09	2					2288.86	2				
2285.22	2d					2288.96	4	Fe I	15	2288.964	43
2285.41	3	Co I	63	2285.408	UV	2289.04	6	Fe I	70	2289.037	7
2285.51	3	Fe II	184	2285.525	UV	2289.25	2h	Vd II	27	2289.219	UV
2285.78	2					2289.35	2	SiO?	(2-0)	2289.380	30
2285.86	5	Cr I?		2285.88	28	2289.61	5	Si I	88	2289.607	37
2286.16	7w	Co II	9	2286.150†	18	2289.86	3				
2286.35	3	Cr I	41	2286.37	UV	2289.98	6	Ni I	5	2289.982	UV
2286.45	5	Fe I		2286.442	29	2290.06	5	Fe I	70	2290.066	7
2286.58?	1					2290.25	2				
2286.70	1h	SiO?	(2-0)	2286.707	30	2290.31	1	SiO	(2-0)	2290.303	30
2286.85	4					2290.49	4				
2286.98	2					2290.55	5	Co I Fe I	66 71	2290.541 2290.553	UV 7
2287.09	5	Ni II	22	2287.089	52	2290.61	2				
2287.26	6	Fe I	14	2287.250	7	2290.77	4	Fe I	70	2290.775	7
2287.32	5	Ni I	34	2287.315	UV	2290.90	4	Fe I		2290.907	29
2287.47	4	Fe I		2287.462	29	2291.04	5	Si I	46	2291.034	37
2287.63	5d	Fe I Ni II	71 38	2287.631 2287.648	7 52	2291.12	5	Fe I Fe I	70 71	2291.119 2291.119	7 7
2287.81	5	Co I	64	2287.804	UV	2291.25	2h	SiO	(2-0)	2291.231	30
2288.03	5	Cd I	1	2288.018†	UV	2291.36	1h				
2288.12	2	As I	6	2288.12	UV	2291.45	4	Co I	68	2291.450	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2291.57	3					2294.19	2	Ti I	14	2294.200	58
2291.61	4	Fe I	17	2291.627	7	2294.31	1				
2291.75	1h	Ti II?		2291.764	56	2294.39	5w	Cu II— I Fe I	13 14	2294.368 2294.408	25 7
2291.82	3h	Ni I—		2291.808	38	2294.60	5	Fe II	184	2294.603	UV
2291.99	5	Co II	21	2291.982	18	2294.77	1h				
2292.17	1	SiO Mn I	(2—0)	2292.180 2292.189	30 4	2294.86	4				
2292.31	2	Co II?		2292.304	18	2295.02	4	Vd II	26	2294.992	UV
2292.42	4	Fe II		2292.435	10	2295.12	3	SiO—	(2—0)	2295.096	30
2292.52	5	Fe I	15	2292.524	7	2295.22	4	Co I	12	2295.223	UV
2292.58	2	Vd II Vd II	26 179	2292.588 2292.588	UV UV	2295.30	3	Fe I		2295.310	29
2292.75	2	Fe II	315	2292.770	UV	2295.40	4	Si I	46	2295.401	37
2292.86	1	SiO	(2—0)	2292.838	30	2295.50	4d	Vd II I Fe I	26 109	2295.504 2295.535	UV UV
2292.90	1					2295.67	2h	Nb II	9	2295.681	UV
2293.12	5d	Ni I Fe II	32	2293.114 2293.116	UV 10	2295.80	1	SiO	(2—0)	2295.789	30
2293.23	1					2295.90	1	Co II		2295.910	18
2293.37	5	I Co II Co II	9	2293.383 2293.383	18 18	2296.06	5d	Co I	68	2296.038	UV
2293.51	3					2296.19	3	Fe I	111	2296.188	29
2293.58	2h					2296.31	2				
2293.75	3	Ti I— I Fe II	14 184	2293.745 2293.765	58 UV	2296.50	4	Pd II	14	2296.53 ‡	UV
2293.84	4	Cu I Fe I	19 15	2293.845 2293.848	32 7	2296.55	5	Ni II	21	2296.552	52
2293.93	3					2296.66	4	Fe II	167	2296.662	UV
2293.99	3	Co I	14	2294.003	UV	2296.74	4d	Co I Fe II	67 133	2296.704 2296.769	UV UV
2294.09	3	Fe I		2294.100	29	2296.90	6d	Fe Fe I	14	2296.890 2296.927	7 7

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2297.15	6d	Ni II Cr II	11 19	2297.141 2297.17	52 UV	2300.48	4	Fe II		2300.497	10
2297.25	3					2300.60	4	Cr II I Fe I	149 108	2300.58 2300.599	UV UV
2297.47	5d	Ni II	11	2297.489	52	2300.71	2	SiO	(1-0)	2300.697	30
2297.78	5	Fe I	14	2297.787	7	2300.77	5w	Ni I	29	2300.774	UV
2297.87	2	SiO	(2-0)	2297.879	30	2300.86	2	SiO SiO	(1-0) (1-0)	2300.871 2300.871	30 30
2298.05	2					2301.02	2	Ni II	39	2301.014	52
2298.12	5H	SiO	(2-0)	2298.100	30	2301.17	4	Fe I		2301.175	7
to		Fe I	14	2298.169	7						
2298.28		I Fe II Ni II	133 21	2298.225 2298.270	UV 52	2301.29	1	SiO SiO	(1-0) (1-0)	2301.277 2301.277	30 30
2298.35	2	Co I	67	2298.356	UV	2301.40	4w	Co II Fe II	9 184	2301.404 2301.424	18 UV
2298.48	3	Ni II	39	2298.491	52						
2298.63	5	Fe I	15	2298.660	7	2301.52	1	SiO— SiO	(1-0) (1-0)	2301.505 2301.531	30 30
2298.73	2h	Co II	21	2298.731	18	2301.57	3W	Ni I?		2301.57	48
2298.86	2h	Mn I		2298.876	4	2301.68	5	Fe I	14	2301.684	7
2298.94	6	Mn II	2	2298.959	19	2302.05	3	Fe I?		2302.06	51
2299.08	1					2302.14	3				
2299.22	6	Fe I	14	2299.220	7	2302.22	1h				
2299.44	5	Fe I	71	2299.453	UV	2302.41	1	SiO	(2-0)	2302.402	30
2299.57	1					2302.48	3w	Ni II	59	2302.479	52
2299.65	4	Ni II	27	2299.651	52	2302.65	2				
2299.75	4h	Co II	21	2299.764	18	2302.73	3	Ti I	14	2302.730	58
2299.84	3	Ti I	14	2299.852	58	2302.94	5	Ni I	32	2302.973	UV
2300.08	3	Ni II	27	2300.097	52	2303.00	5	Ni II	11	2302.996	52
2300.13	6	Fe I	15	2300.142	7	2303.05	5	Si I	87	2303.058	37
2300.25	4	Fe I		2300.242	29	2303.34	4w	II Fe II SiO	167 (1-0)	2303.349 2303.353	UV 30
2300.30	4										

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2303.41	4w	Fe I	15	2303.424	7	2306.17	4	Fe I	71	2306.172	7
2303.50	2	II Co I SiO?	10 (0-0)	2303.504 2303.518	UV 30	2306.40	5w	Fe I	111	2306.382	7
2303.58	4	Fe I	15	2303.581	7	2306.58	4w	SiO-	(1-0)	2306.554	30
2303.84	3	-Ni II	51	2303.848	52	2306.70	1	Fe II SiO	(1-0)	2306.677 2306.704	10 30
2303.97	3d	Co I SiO	62 (1-0)	2303.966 2303.985	UV 30	2306.81	3	Cr II	19	2306.81	UV
2304.07	2	Ti II?		2304.09	38	2306.88	1	Fe SiO	(1-0)	2306.856 2306.883	7 30
2304.19	3	Co I	11	2304.182	UV	2306.99	2h	SiO Co II	(1-0)	2306.966 2307.003	30 18
2304.24	3	Ba II	2	2304.248	UV	2307.19	4	Cr II	19	2307.19	UV
2304.35	2h	SiO	(1-0)	2304.321	30	2307.25	} 3D	Sr I	7	2307.264	16
2304.45	1	SiO?	(1-0)	2304.484	30	2307.28		Fe II		2307.311	23
2304.53	3	Fe I		2304.544	29	2307.35		INi I	35	2307.351	UV
2304.64	3	SiO SiO	(1-0) (2-0)	2304.653 2304.653	30 30	2307.39	5	IFe I SiO	13 (1-0)	2307.374 2307.391	43 30
2304.74	5	Fe I Fe II	71 184	2304.734 2304.736	7 UV	2307.52	2H	Co II- SiO?	(1-0)	2307.509 2307.556	18 30
2304.88	1h	Fe II		2304.910	23	2307.78	4	Co II Ni II	21 38	2307.749 2307.781	18 52
2305.01	5w	Mn II	2	2305.009	19	2307.85	5	Co II	9	2307.851	18
2305.17	4	Co I	14	2305.169	UV	2308.01	1	SiO	(1-0)	2308.008	30
2305.24	4	Ni II	38	2305.239	52	2308.11	1	SiO	(1-0)	2308.125	30
2305.33	2					2308.16	4	Ni I		2308.168	UV
2305.46	2d					2308.29	1h	SiO	(1-0)	2308.279	30
2305.61	1	SiO	(1-0)	2305.602	30	2308.51	4	Ni II	50	2308.518	52
2305.68	3	Ti I	14	2305.665	58	2308.59	1	SiO	(1-0)	2308.595	30
2305.76	1	SiO	(1-0)	2305.773	30	2308.75	2	SiO	(1-0)	2308.737	30
2305.98	2	SiO	(1-0)	2306.001	30						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2309.01	6W	Fe I	14	2308.999	7	2312.55	3	Co II	21	2312.558	18
		Co I	11	2309.03	UV	2312.64	2	Fe II		2312.654	10
2309.08	2	SiO	(1-0)	2309.068	30	2312.92	4	Ni II	58	2312.916	52
		Vd II?	26	2309.072	UV	2313.10	6	Fe I	14	2313.104	7
2309.20	1	SiO	(1-0)	2309.206	30	2313.20	4	Fe II?		2313.194	10
2309.48	5w	Ni I		2309.484	UV	2313.31	3	Fe II	288	2313.300	UV
2309.55	3	-SiO	(1-0)	2309.560	30	2313.35	4				
2309.67	2h	SiO	(1-0)	2309.692	30	2313.51	2H	Al I	12	2313.526	14
2309.83	3h					2313.60	6	Co II	21	2313.609	18
2309.89	1	SiO	(1-0)	2309.907	30	2313.65	3	Ni I		2313.649	UV
2310.01	4	Ni I		2310.016	UV			Fe I		2313.650	29
2310.06	1	SiO	(1-0)	2310.062	30	2313.99	6	Fe II	184	2313.962	UV
2310.17	3	Fe		2310.166	7			Ni I	10	2313.976	UV
		SiO	(1-0)	2310.189	30	2314.04	5	Co II	9	2314.050	18
2310.31	2					2314.17	2h	Ge I	10	2314.201	25
2310.78	4					2314.32	1h	Ti I	14	2314.289	58
2310.96	8W	Ni I	10	2310.952	UV			Fe I		2314.337	29
2311.22	4	Fe II	245	2311.224	UV	2314.71	5d	II Cr II	19	2314.71	UV
								Fe II?		2314.715	10
2311.35	4	Co I	15	2311.38	UV	2314.81	4	Cr II	19	2314.81	UV
		Co I	62	2311.38	UV	2314.98	6d	Co II-	9	2314.965	18
2311.48	3h	Sb I	1	2311.47	UV			Al I	12	2314.983	14
2311.60	5	Co II	9	2311.606	18	2315.29	1	Fe II		2315.314	23
2311.76	1	SiO	(1-0)	2311.763	30	2315.43	1h				
2311.89	3					2315.59	5				
2312.02	5	Fe II	105	2312.028	UV	2315.77	2h	Fe II		2315.750	23
2312.22	3	Fe II		2312.227	10	2316.03	6W	Ni II	11	2316.039	52
		Ni II	27	2312.240	52	2316.15	5	Co I	14	2316.157	UV
2312.34	7W	Ni I	10	2312.335	UV						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2316.24	2					2319.46	3h	Fe I		2319.441	29
2316.35	1					2319.55	3	Cu I	22	2319.563	32
2316.46	1					2319.65	4	-Fe I		2319.680	29
2316.58	1					2319.77	3	Ni II	37	2319.750	52
2316.73	2d	Co I		2316.733	50	2320.04	8W	II Ni I— Cr II	9 19	2320.026 2320.08	UV 27
2316.84	4	Co I Co I	11 64	2316.843 2316.843	UV UV	2320.34	6W	Fe I	14	2320.358	7
2317.16	7W	Ni I	8	2317.159	UV	2320.62	1				
2317.36	3	Fe II	183	2317.377	UV	2320.77	1				
2317.52	2h	Al I Co I	12	2317.482 2317.516	14 50	2320.86	1				
2317.66	2					2320.97	2				
2317.82	3					2321.07	3				
2317.90	4	Fe I	111	2317.898	7	2321.40	7W	Ni I	9	2321.377	UV
2318.16	6	Fe I		2318.151	7	2321.45	5				
2318.33	4	Fe II	183	2318.343	UV	2321.60	4	Al I	12	2321.562	14
2318.42	3	Co II	21	2318.430	18	2321.69	5	Fe II	183	2321.687	UV
2318.52	5	Ni II Fe II	38 132	2318.509 2318.534	52 UV	2321.83	3	Fe I		2321.830	43
2318.67	1	Fe II		2318.648	38	2321.88	2				
2318.77	4	Ni I	58	2318.770	UV	2321.96	6	Ni I	34	2321.953	UV
2318.91	2	Mn II?		2318.91	19	2322.05	2	Co II—		2322.018	18
2319.00	4	Fe I	13	2318.992	43	2322.21	1				
2319.09	4	Al I	12	2319.057	14	2322.33	3	Fe II	183	2322.326	UV
2319.15	1	Co I	13	2319.152	UV	2322.45	1				
2319.24	4h					2322.61	2				
2319.37	4	Cr II	34	2319.38	UV	2322.69	6	Ni I Fe I		2322.683 2322.684	UV 29
						2322.94	2	Fe II		2322.949	10

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2322.99	1	Fe		2323.014	7	2326.13	6	Co II	8	2326.111	18
2323.09	4							Co II— Fe		2326.111	18
2323.15	5	Co I	11	2323.131	UV	2326.23	2	Mn II		2326.22	19
2323.33	1							Fe II		2326.234	10
2323.42	3	Fe I		2323.422	7	2326.30	2				
2323.63	3	Fe I	12	2323.627	29	2326.37	2	Fe II		2326.353	23
2323.67	2					2326.44	} 6d	Ni II	11	2326.451	52
2323.76	1	Mn I		2323.748	4	2326.48		Co II	8	2326.471	18
2323.86	1					2326.82	1	Fe II?		2326.816	7
2324.05	1					2326.96	2h	C II	0.01	2326.930	37
2324.15	3	Fe I		2324.128	7	2327.23	4				
2324.25	3	Co II	21	2324.235	18	2327.31	3				
		Fe I		2324.260	29	2327.41	7W	Fe II	3	2327.391	UV
2324.31	5w	Co II	8	2324.300	18	2327.64	3h	Co II		2327.672	18
2324.47	1	Fe II		2324.474	10			Fe II		2327.675	38
2324.65	5	Ni I	14	2324.645	UV	2327.96	4	Fe II	183	2327.953	UV
2324.88	2w					2328.06	3				
2325.04	4d	Ti II		2325.044	56	2328.30	1h	Co I		2328.298	UV
		Fe II		2325.050	23	2328.59	5w				
2325.13	4					2328.75	2	Fe I		2328.749	7
2325.30	4	Fe II	183	2325.296	UV	2328.86	5d	Mn II		2328.84	19
2325.38	1	C II	0.01	2325.398	37			Fe I		2328.851	43
2325.48	2					2329.02	2				
2325.56	5d	Co I	14	2325.530	UV	2329.10	3	Fe I		2329.093	29
		Fe II	288	2325.577	UV			Co II		2329.106	18
2325.80	7W	Ni I	9	2325.794	UV	2329.35	1	Fe II		2329.358	23
2325.93	3	Mn II		2325.93	19	2329.40	1				
						2329.51	1	Vd I	31	2329.529	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2329.63	4	Fe I	12	2329.641	7	2333.97	2h				
2329.73	2	Fe I	13	2329.742	43	{ 2334.10	2d	Fe I	62	2334.103	43
2329.96	7W	Ni I	8	2329.963	UV			Co I		2334.12	50
2330.09	2						2	Cr II		2334.17	UV
2330.16	2h					2334.22	3	Cr II	47	2334.24	UV
2330.34	4w	Co II	8	2330.356	18	2334.29	1	Fe II		2334.293	10
2330.49	1					{ 2334.34	2	Fe		2334.321	7
2330.57	1						3	Cr II	47	2334.37	UV
2330.68	2h	Cr I?		2330.71	28		2	Si II	0.01	2334.404	37
2330.86	2h					2334.44	2	Vd I	31	2334.434	UV
2331.07	6	Fe II	183	2331.076	UV	{ 2334.51	4W	Fe II	110	2334.522	10
		Fe I	108	2331.088	29			Fe I		2334.524	43
								Cr II		2334.58	UV
2331.30	7W	Fe II	35	2331.308	UV	2334.59		Ni II	20	2334.584	52
2331.70	6	Ni I	13	2331.698	UV			Si II	0.01	2334.606	37
2331.77	5					2334.67	2				
2331.93	2h					2334.75	1	Fe		2334.726	7
2332.09	2h	Co I		2332.087	UV	2334.79	1	Rh II	27	2334.77 ‡	UV
2332.44	2					2334.84	3	Cr II	47	2334.83	UV
2332.82	9W	Fe II	3	2332.798	UV	2335.00	2h	Fe		2335.024	7
2333.07	5	Co I	15	2333.071	UV	2335.08	1h	Co I	6	2335.102	UV
2333.31	2	Cr I	40	2333.33	UV	2335.21	5d				
		Vd I	31	2333.33	UV	2335.45	1h	Vd II	55	2335.480	UV
2333.44	4	Cr II	47	2333.46	UV	2335.57	3	Fe II		2335.570	10
2333.61	2					2335.68	2	Fe		2335.702	7
2333.69	2h	Fe II		2333.707	23	2335.75	3	Fe II		2335.757	10
2333.83	2d	Cr II	47	2333.84	UV	2335.99	4	Co I	11	2335.98	UV
		Cr II	47	2333.87	UV	2336.07	1	Fe I	12	2336.054	43
								Vd II?	57	2336.098	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2336.22	4	Co II	8	2336.230	18	2340.02	4	Fe I	12	2340.020	43
2336.34	2					2340.14	1				
2336.42	2					2340.25	4	Fe I?		2340.26	51
2336.50	2	Fe I		2336.512	43	2340.35	2	Fe II	344	2340.352	23
2336.62	3w	-Ni II	27	2336.625	52	2340.45	4d	I Fe II Vd I	166 31	2340.459 2340.479	UV UV
2336.71	3	Ni II	50	2336.712	52	2340.59	1	Fe II		2340.561	23
2336.84	3h	Fe II		2336.828	10	2340.69	4	Fe II?—		2340.688	38
2336.97	2	Co II		2336.999	18	2340.77	3				
2337.09	4	Ni I	29	2337.087	UV	2340.93	4	Fe II	166	2340.939	UV
2337.20	3					2341.00	3	Co I	62	2340.99	50
2337.30	2W					2341.12	4	Co II		2341.120	18
2337.48	7	Ni I	8	2337.484	UV	2341.19	4	Cr I II Ni II	40 50	2341.17 2341.202	UV 52
2337.81	7	Fe II II Ni I	32	2337.789 2337.814	10 UV	2341.36	3	Fe I		2341.373	29
2338.00	9W	Fe II	3	2338.005	UV	2341.43	1	Fe II		2341.444	23
2338.49	5	Ni I	30	2338.493	UV	2341.56	5	Fe I	13	2341.575	UV
2338.66	5	Co I	11	2338.656	UV	2341.71	1	Fe II		2341.676	10
2338.83	3					2341.78	1	Co I		2341.784	50
2339.05	4	Co I	12	2339.048	UV	2341.87	1				
2339.25	1	Cr I	40	2339.27	UV	2341.94	4	Fe II	314	2341.953	23
2339.34	3					2342.06	1w				
2339.40	4	Fe II	105	2339.408	UV	2342.13	2	Vd II	55	2342.142	UV
2339.50	3	Fe I		2339.508	7	2342.25	6	Fe II	104	2342.238	UV
2339.64	4d	Fe Vd I	31	2339.645 2339.673	7 UV	2342.52	3	Fe I		2342.510	43
2339.75	2	Fe II		2339.748	10	2342.56	2	Fe I		2342.551	43
2339.84	3h	Fe II		2339.862	10						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2342.79	3	Co I	15	2342.793	50	2346.50	3	Fe II	379	2346.508	UV
2343.13	2					2346.57	4	Co II		2346.563	18
2343.29	2	Fe		2343.307	7	2346.63	6	Ni I	12	2346.628	UV
2343.50	9 <i>W</i>	Fe II	3	2343.495	UV	2346.74	4				
2343.74	5					2346.86	1	Vd II	54	2346.868	UV
2343.97	5 <i>W</i>	Fe II	35	2343.958	UV	2347.02	4	-Vd I	31	2347.026	UV
2344.28	6 <i>W</i>	Co II I Fe II	8 3	2344.276 2344.278	18 UV	2347.08	4				
2344.62	2 <i>h</i>	Fe Co II		2344.602 2344.628	7 18	2347.14	2	Fe II		2347.138	23
2344.70	3 <i>h</i>					2347.39	5	Co II	8	2347.396	18
2344.98	4	Fe II		2344.984	7	2347.46	4	Ti II	18	2347.46	UV
2345.02	6	Fe I		2345.018	29	2347.51	5	Ni I	5	2347.507	UV
2345.18	2	Fe II	287	2345.177	UV	2347.58	4	Ba II	2	2347.592	UV
2345.26	4	Cr II I Ni II	34 58	2345.25 2345.267	UV 52	2347.77	2	Fe Co II		2347.778 2347.804	7 18
2345.34	5 <i>d</i>	I Fe II Cr II	165 34	2345.327 2345.35	UV UV	2347.88	4				
2345.46	5 <i>d</i>	Ni II- Fe I	11 13	2345.442 2345.489	52 43	2348.13	7 <i>W</i>	Fe II	36	2348.118	UV
2345.55	7 <i>w</i>	Ni I	6	2345.539	UV	2348.31	8 <i>W</i>	Fe II	3	2348.300	UV
2345.76	2					2348.40	3	Ti II		2348.40	38
2345.84	4					2348.48	3				
2345.95	5	Fe II		2345.964	38	2348.61	4 <i>h</i>	Be I	1	2348.610†	22
2346.07	5	Ni I		2346.074	UV	2348.73	4 <i>d</i>	Ni I-	32	2348.734	UV
2346.17	4	Co I	12	2346.161	UV	2348.92	2	Cr I	40	2348.92	UV
2346.29	6	Fe II Fe II	314 379	2346.271 2346.271	UV UV	2349.02	1				
2346.38	4	Ti II	18	2346.362	56	2349.14	4				
						2349.34	3				
						2349.47	2				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2349.62	4					2352.39	2	Fe I?		2352.39	51
2349.69	2					2352.45	3h	Ti II?		2352.47	38
2349.83	2	As I	6	2349.84	UV	2352.54	1				
2349.94	4d	Ti II	18	2349.944	56	2352.60	3	Au I	5	2352.58	UV
2350.04	1					2352.68	2				
2350.17	4d	Si II Fe II	0.01 379	2350.174 2350.186	37 UV	2352.87	4	Co I	60	2352.864	UV
2350.28	3	Co I	63	2350.284	UV	2352.94	4	Mn I—	35	2352.937	UV
2350.42	5d	Cr I I Fe I Fe I	40 11 69	2350.40 2350.411 2350.411	UV 7 7	2353.04	2				
2350.62	4d	Co I Fe I Ti II		2350.596 2350.626 2350.640	50 29 56	2353.21	1	Zr II	16	2353.21	UV
2350.84	4d	I Be I Ni II?		2350.829 2350.845	22 52	2353.31	3				
2351.00	2					2353.37	4	Co I	11	2353.36	UV
2351.18	5w	Fe II	165	2351.198	UV	2353.41	5	Co II	8	2353.410	18
2351.37	4	Co I	13	2351.385	UV	2353.47	2	Fe II		2353.470	
2351.52	2h					2353.55	4				
2351.62	2	Fe		2351.607	7	2353.68	4w	Fe II	379	2353.682	UV
2351.67	3	Fe II	379	2351.672	UV	2353.80	3w				
2351.88	5W	Fe I Fe I	12	2351.884 2351.884	29 29	2353.84	2				
2351.97	2	Fe II		2351.958	23	2354.09	4d				
2352.04	1					2354.30	2	Cr I	40	2354.30	UV
2352.18	2	I Vd II Co II?	55	2352.177 2352.202	UV 18	2354.51	6W	Fe II	165	2354.473	UV
2352.26	3					2354.88	6W	Fe II	35	2354.884	UV
2352.30	3	Fe II	379	2352.315	UV	2355.06	5	Ni I	31	2355.050	UV
						2355.15	2	Ti II	18	2355.147	56
						2355.21	4	Fe II	165	2355.218	UV
						2355.33	3	Fe I Fe II	11 379	2355.334 2355.351	7 UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2355.41	1	C I	61.01	2355.445	37	2357.81	3	Vd II	187	2357.810	UV
2355.48	4	Co I	11	2355.480	UV			Ti II	18	2357.828	56
2355.61	2h	Co I	63	2355.611	UV	2357.93	3	Ru II	42	2357.92	UV
2355.70	2					2358.18	5	Co I	11	2358.177	UV
2355.73	3							Co II		2358.203	18
2355.76	3					2358.43	1h	Mn II	38	2358.448	19
2355.83	1	Ti II	18	2355.86	UV	2358.52	1h	Fe II		2358.516	10
2355.91	3	Fe I	12	2355.915	UV	2358.62	4	Fe I		2358.622	29
2356.09	1					2358.68	2	Co I	6	2358.676	UV
2356.19	4	Fe II		2356.185	10	2358.85	5	Ni I	29	2358.853	UV
		Fe I		2356.196	29	2359.10	8W	Fe II	3	2359.111	UV
2356.28	4h	Co I	10	2356.267	UV			Fe II	165	2359.111	UV
2356.41	5	Ni II	22	2356.403	52			Fe II	379	2359.111	UV
2356.58	5					2359.37	2				
2356.69	1					2359.44	2	Mn II?	38	2359.47	19
2356.87	5	Ni I	30	2356.864	UV	2359.57	5	Fe II	165	2359.594	UV
2356.95	1					2359.86	3h				
2357.01	3d	Fe II	333	2357.005	UV	2360.01	7W	Fe II	35	2359.999	UV
		Fe II	379	2357.005	UV	2360.29	7W	Fe II	36	2360.287	UV
2357.12	3					2360.41	2	Fe		2360.411	7
2357.16	1					2360.52	3h	Co II		2360.506	18
2357.29	2d							Fe II		2360.514	23
2357.39	1h					2360.62	4	Ni I	10	2360.633	UV
2357.52	5d	Co I—	114	2357.507	UV	2360.75	4	Fe I		2360.755	29
2357.64	1					2360.87	3				
2357.71	3	Fe I		2357.712	43	2361.03	2	Fe		2361.009	7
2357.77	3					2361.09	3	Fe II		2361.072	10
						2361.36	2h	Fe II	270	2361.371	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2361.51	4	Co II	8	2361.517	18	2363.99	3d	~Cr II	10	2364.02	UV
2361.57	3					2364.29	1				
2361.72	4w	Fe II	165	2361.728	UV	2364.43	2h	Fe I		2364.436	43
		Fe II	379	2361.728	UV	2364.84	8W	Fe II	3	2364.825	UV
2361.75	1	Mn II	38	2361.768	19	2365.05	5	Co I	6	2365.057	UV
2361.87	2					2365.25	1	Cr II	111	2365.26	UV
2361.92	3	Fe I		2361.936	29			Cr II	203	2365.26	UV
2361.96	3					2365.40	1h				
2362.00	5	Fe II	35	2362.014	UV	2365.51	4	Fe I	107	2365.509	UV
2362.06	5	Ni I	5	2362.070	UV	2365.66	4	Ni I	8	2365.657	UV
2362.09	4	Fe II	117	2362.118	38	2365.77	3	Fe II		2365.771	23
2362.19	2	Cr I	40	2362.19	UV	2365.92	4	Cr I	1	2365.91	UV
2362.33	2	Co I	62	2362.327	UV	2366.04	4d	Fe II	287	2366.040	UV
2362.50	2							Co I		2366.046	50
2362.56	2							Fe II		2366.065	38
2362.61	3	Fe I		2362.624	29	2366.14	3	Cr I	40	2366.14	UV
2362.77	1					2366.21	3				
2362.86	2					2366.31	3	Cr I	39	2366.31	UV
2363.06	1					2366.38	3				
2363.12	2	Fe II		2363.115	10	2366.51	3	Vd II?— INi II	25 36	2366.490 2366.542	UV 52
2363.14	3					2366.60	5W	Fe II	35	2366.591	UV
2363.37	3					2366.70	3				
2363.41	4	Fe II		2363.403	10	2366.75	3	Cr II?	34	2366.75	UV
2363.64	4w	Fe II	165	2363.641	UV	2366.82	4	Cr I	1	2366.81	UV
								Cr II	34	2366.84	UV
2363.77	4	Co II	8	2363.796	18			Cr II	34	2366.84	UV
2363.81	5	Fe II	270	2363.811	UV	2366.86	4	Fe II	2	2366.864	UV
								Fe II	165	2366.864	UV
2363.86	4d	Fe II	379	2363.855	UV	2366.90	2	Vd II	43	2366.883	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2367.05	6w	Al I	4	2367.053	14	2370.52	6W	Fe II Co I	35 8	2370.494 2370.514	UV UV
2367.19	2	Co II?		2367.205	18	2370.62	4	Fe II	182	2370.612	38
2367.33	3					2370.74	3	Co II Al I Fe	11	2370.720 2370.726 2370.774	18 14 7
2367.40	5	Ni II	11	2367.385	52	2370.82	2	Fe I		2370.808	43
2367.61	3	Al I	11	2367.611	14	2370.94	1	Fe II		2370.951	23
2367.71	3					2371.07	1				
2367.81	4	Ni I		2367.803	38	2371.14	3				
2367.87	2	Cr I	10	2367.86	UV	2371.21	3				
2368.13	3	Al I	11	2368.112	14	2371.38	3	Fe II		2371.357	38
2368.49	3	Cr I	39	2368.49	UV	2371.44	6	Fe I Co I	11 133	2371.430 2371.458	7 UV
2368.60	7W	Fe II	36	2368.593	UV	2371.63	1W				
2368.89	3	Fe I		2368.884	43	2371.74	2	Fe II		2371.706	10
2369.24	4	Ni II Fe II	36 182	2369.218 2369.232	52 UV	2371.86	4	Co I	12	2371.845	UV
2369.30	3	Ti I Al I	13 11	2369.283 2369.304	58 14	2371.97	2	Ti I	12	2371.957	58
2369.46	5	Fe I	11	2369.456	7	2372.08	5w	Al I Al I	3 11	2372.070 2372.070	14 14
2369.68	4	Co I	60	2369.674	UV	2372.28	3	Ti I—	12	2372.254	58
2369.75	4	Fe Fe II		2369.727 2369.740	7 10	2372.36	3	Fe II		2372.361	10
2369.90	2	Cu II	51	2369.890	25	2372.55	2W	—Vd II	25	2372.584	UV
2369.94	4	Co I Fe II	62 379	2369.924 2369.960	UV UV	2372.64	3	Fe II	333	2372.631	UV
2370.04	4h	Fe I	67	2370.031	43	2372.74	1	Ir I?	1	2372.774	UV
2370.23	2	Al I	11	2370.225	14	2372.81	3	Fe II Co I	148 9	2372.777 2372.832	UV UV
2370.37	3	Cr I	39	2370.37	UV	2372.86	3	Cr I	39	2372.88	UV
						2373.13	6w	Al I	4	2373.122	14

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2373.36	5w	Al I	4	2373.351	14	2376.51	3				
2373.58	2	Al I	11	2373.571	14	2376.64	2				
2373.63	6	Fe I	11	2373.624	7	2376.69	1				
2373.69	3	Cr I	39	2373.69	UV	2376.76	3	Fe II		2376.737	23
2373.75	8W	Fe II	2	2373.733	UV	2376.91	1				
2373.88	2	Co I	13	2373.862	UV	2376.98	4	Fe I Co I		2376.971 2376.975	29 50
2374.21	1					2377.05	1				
2374.45	2d	Zr I— Co I	15 13	2374.43 2374.456	UV 50	2377.21	3	Mn I	2	2377.183	UV
2374.52	5	Al I I Fe I	11 11	2374.496 2374.518	14 7	2377.25	5	Co I— Fe I? Pt II	63 12	2377.215 2377.24 2377.276	UV 51 UV
2374.58	2	Ti I	13	2374.591	58						
2374.71	1					2377.40	3	Fe II		2377.426	10
2374.88	3	Fe II		2374.870	23	2377.51	2w				
2375.20	7W	Co II I Fe II	8 36	2375.189 2375.192	18 UV	2377.76	1				
2375.44	5w	Ni II	21	2375.418	52	2377.82	3				
2375.66	2	Fe I		2375.678	29	2377.88	5	Fe I		2377.891	7
2375.88	3	Fe I		2375.880	43	2377.98	5	Fe I	107	2377.991	UV
2375.97	2	Fe I		2375.990	29	2378.12	3w	Fe II Ti I	12	2378.135 2378.145	10 58
2376.02	5	Ni II Ni I	11 30	2376.010 2376.016	52 UV	2378.28	3				
2376.13	2					2378.39	5	Al I	3	2378.395	14
2376.20	1					2378.52	5	Fe II Fe II	270 377	2378.526 2378.526	UV UV
2376.30	3	Fe I Au I	4	2376.276 2376.28	29 UV	2378.64	6d	Fe I Co II	7	2378.604 2378.622	29 18
2376.37	3					2378.80	1	Fe		2378.820	7
2376.42	5	Fe II	379	2376.435	UV	2378.92	3	Co I	125	2378.905	UV
						2379.00	4	Fe II	182	2379.003	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2379.14	5	Ge I	9	2379.144	25	2383.26	6w	II Fe II	36	2383.242	UV
		Vd II	43	2379.149	UV			Cr I	39	2383.303	UV
		I Fe II	211	2379.155	UV						
		ICo I	12	2379.160	UV	2383.45	6	Co II	7	2383.452	18
2379.28	7W	Fe II	36	2379.275	UV	2383.78	3W	Fe I		2383.790	29
2379.40	2	Fe II		2379.392	23	2383.98	2	Vd II	25	2383.995	UV
2379.46	2					2384.04	4	Mn I	2	2384.049	UV
2379.56	3	Cr I	38	2379.56	UV	2384.39	6W	I Fe II	36	2384.386	UV
2379.71	3	Ni I	55	2379.720	UV			Ni I	10	2384.390	UV
2379.81	4	-Cr I	39	2379.85	UV	2384.85	4	Co I	5	2384.858	UV
2379.94	2	Cr I	10	2379.95	UV	2384.98	4W	Fe II	35	2384.999	UV
2380.01	2d	-Fe II?		2380.028	38	2385.01		Ni I		2385.011	UV
2380.26	1	Fe I		2380.284	43	2385.05		Fe I		2385.038	43
2380.34	3	Fe I		2380.345	43	2385.32	1				
2380.47	4	Cr I	10	2380.46	UV	2385.38	3h	Fe I		2385.386	29
		ICo I	6	2380.483	UV	2385.43	1				
		Co I	61	2380.483	UV	2385.57	3	Fe I		2385.580	29
2380.76	8W	Fe II	3	2380.757	UV	2385.71	2	Cr I	39	2385.72	UV
2381.37?	1	Cr I?	70	2381.36	UV	2385.78	3	Co I		2385.813	UV
2381.45?	1	Cr II	34	2381.48	UV	2385.93	3	Fe I	69	2385.916	43
		Cr II	34	2381.48	UV	2386.07	1h				
2381.63	1	Fe I		2381.611	43	2386.20	3w	Cr I	38	2386.18	UV
2381.80	8	Co II-		2381.763	18	2386.36	6	Co II	7	2386.370	18
		Fe I	11	2381.835	7			Fe II	396	2386.387	10
2382.03	9W	Fe II	2	2382.034†	UV	2386.46	2				
2382.22	5w	Fe II-		2382.215	38	2386.58	6	Ni I	32	2386.585	UV
2382.37	2	Fe II	35	2382.356	UV	2386.72	3	Co II		2386.716	18
2382.90	5w	Fe II	117	2382.902	UV	2386.77	1	Cr I	36	2386.77	UV
2383.05	6w	Fe II	2	2383.060	UV						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2386.99	2h	Mn II?	48	2387.004	19	2389.86	3	Fe II	244	2389.870	UV
2387.11	3h					2389.97	5h	Fe I	11	2389.973	7
2387.28	4	Fe I		2387.278	51	2390.07	2	Fe II		2390.104	23
2387.36	2	Fe II		2387.380	23	2390.19	1				
2387.43	3h	Fe II— Co I	286	2387.424 2387.460	UV 50	2390.28	3	Fe II	304	2390.311	UV
2387.54	4	Ni I	54	2387.549	UV	2390.42	2	Co I		2390.426	UV
2387.58	1					2390.52	2w	Fe I		2390.523	43
2387.69	3					2390.57	3	Fe II	304	2390.546	UV
2387.76	4	Au I Ni II	4 19	2387.75 2387.764	UV 52	2390.74	2	Fe II	402	2390.766	UV
2387.82	3	Fe I	67	2387.830	29	2391.07	4	Fe II?	388	2391.043	38
2387.88	1	Fe I?	69	2387.913	43	2391.11	2	Fe I?		2391.131	43
2387.95	3					2391.30	2				
2388.08	3	Fe I		2388.090	29	2391.37	3	Co I		2391.369	UV
2388.21	3d	Co I Fe II	59 148	2388.175 2388.230	UV UV	2391.48	5W	Fe II	35	2391.475	UV
2388.38	2	Co I Fe II	10 117	2388.374 2388.387	UV UV	2391.82	4	Fe I		2391.826	29
2388.65	8W	Fe II	2	2388.629	UV	2391.92	2w				
2388.94	7	Co II	7	2388.915	18	2392.02	5	Co I	6	2392.029	UV
2389.23	2h	Fe II		2389.263	10	2392.09	3	Ni II	36	2392.106	52
2389.40	3					2392.23	2				
2389.44	2	Cr I Fe II	36	2389.43 2389.431	UV 23	2392.34	2h	Cr I	36	2392.34	UV
2389.52	5	Co II	7	2389.540	18	2392.52	1				
2389.68	} 3D	Vd II	25	2389.696	UV	2392.59	4	Co II— Ni II	36	2392.568 2392.588	18 52
2389.73		Cr II	146	2389.75	UV	2392.64	4	Cu I	19	2392.630	32

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2392.86	3	Cr I	36	2392.86	UV	2396.09	3w	Fe II		2396.086	10
2392.95	5	Ni I	31	2392.961	UV	2396.22	1	Co I	132	2396.232	UV
2393.01	2					2396.38	4	Cr I INi I	36 12	2396.36 2396.378	UV UV
2393.11	4	Fe I Ni I	66 31	2393.094 2393.109	29 UV	2396.64	4	Ni I	53	2396.630	UV
2393.17	2					2396.72	4	Ru II Fe II	41 211	2396.71 2396.714	UV UV
2393.46	2h	Fe II		2393.453	10	2396.76	2h	Co I		2396.779	UV
2393.56	1					2397.05	3w	Co I Fe I		2397.03 2397.058	50 43
2393.71	3					2397.18	2				
2393.89	4	Co II	8	2393.901	18	2397.26	1	Co I		2397.25	50
2393.99	2	Fe II Cr II		2393.989 2393.99	23 UV	2397.38	4	Co II	16	2397.389	18
2394.05	3	Fe I		2394.058	29	2397.54	2				
2394.17	1	Fe II	303	2394.172	23	2397.75	3	Cr II	43	2397.75	UV
2394.22	1	Co I		2394.227	50	2397.82	2	Fe II		2397.828	23
2394.29	4	Fe I		2394.303	29	2397.99	2h				
2394.40	3					2398.07	1w				
2394.51	5W	Ni II	20	2394.519	52	2398.23	3	Fe I	106	2398.215	UV
2394.63	1					2398.35	2				
2394.71	2	Fe I		2394.699	43	2398.39	2	Co II		2398.380	18
2394.82	}4D	Ni II	36	2394.843	52	2398.56	5	Ca I		2398.559	45
2394.88		Fe II	116	2394.892	UV	2398.65	1	Fe II	402	2398.664	UV
2394.97	3w	Ni I	30	2394.989	38	2398.70	2	Fe I	107	2398.726	29
2395.18	2	Fe I		2395.186	29	2398.90	1w				
2395.42	6W	Fe II	2	2395.416	UV	2399.25	8W	IFe II Fe II	2 36	2399.237 2399.237	UV UV
2395.62	9W	Fe II	2	2395.627	UV						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2399.64	1	Fe II Cr II	303 235	2399.636 2399.67	23 UV	2402.26	3	Fe II Fe II	181	2402.255 2402.255	UV 23
2399.72	1					2402.42	} 2d				
2399.99	} 3D					2402.46		Fe II	377	2402.450	UV
2400.02						2402.54	3	Fe I— Co I	61	2402.522 2402.559	43 UV
2400.05		Fe II		2400.059	23	2402.59	4w	Fe II	36	2402.597	UV
2400.27	3w	Cr II I Fe II	170 181	2400.24 2400.274	UV UV	2402.75	2h	Ru II	41	2402.72 ‡	UV
2400.34	4	Fe II	244	2400.338	UV	2402.95	3	Fe I		2402.938	29
2400.41	2					2403.11	2H	Pt I—	8	2403.10	UV
2400.55	2	Co I	115	2400.558	UV	2403.35	2H	Cu II Co I	76	2403.337 2403.337	25 50
2400.64	3					2403.54	3	Fe I		2403.542	29
2400.84	2	Co I	60	2400.833	UV	2404.19	5	Co II	7	2404.167	18
2400.98	3					2404.45	5W	Fe II	2	2404.430	UV
2401.10	} 4D	Co I		2401.102	50	2404.93	9W	Fe II	2	2404.882	UV
2401.14		Fe I		2401.136	29	2405.32	1h	Fe I		2405.302	29
2401.19	1					2405.69	1	Fe II	402	2405.688	UV
2401.29	3	Fe II	402	2401.301	UV	2406.10	3h	Fe II	131	2406.086	UV
2401.42	1h					2406.24	2	Co I	58	2406.266	UV
2401.50	3h	Fe I?		2401.52	51	2406.66	8W	Fe II	2	2406.660	UV
2401.60	3	Co I	10	2401.595	UV	2406.88	3	Ni II	36	2406.875	52
2401.78	2					2406.98	4	Fe II	302	2406.982	UV
2401.85	5	Ni I	6	2401.839	UV	2407.24	5	Co I	6	2407.249	UV
2401.98	1					2407.58	2	Fe I?		2407.60	51
2402.07	} 4D	Co I	5	2402.058	UV	2407.66	3	Co II		2407.655	18
2402.12		Fe II		2402.079	23	2407.76	3	Fe II	396	2407.765	UV
2402.17		Fe I		2402.109	29						
2402.17	2	Co I	12	2402.164	UV						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2407.93	3h	Fe II	116	2407.940	UV	2412.16	3	Fe I		2412.172	29
2408.04	4	Fe I	67	2408.046	7	2412.26	3	Ni II	11	2412.265	52
		Fe I	68	2408.062	7	2412.48	3	Ni I	5	2412.489	38
2408.40	3	Co II		2408.424	18	2412.64	4	Ni I	8	2412.640	UV
2408.53	1					2412.75	4	Co I	10	2412.762	UV
2408.61	3	Cr I	36	2408.60	UV	Fe I	64			2412.766	29
2408.75	4	Cr I	36	2408.72	UV	2412.89	3	Co I		2412.896	UV
		Co II	7	2408.754	18	2413.03	4	Vd I	23	2413.031	UV
2408.85	1	Mn II	37	2408.857	19	INi II	19			2413.040	52
2408.92	2h					2413.31	8W	Fe II	2	2413.308	UV
2409.03	2					2413.55	1h	Co I	125	2413.580	UV
2409.11	2	Co I		2409.123	50	2413.68	1h				
2409.20	1					2413.74	3	Fe I		2413.764	29
2409.37	4d	-Fe II	150	2409.377	UV	2413.90	2h				
2409.47	2					2413.97	2	Fe II		2413.998	23
2409.58	2					2414.07	5d	Co II		2414.071	18
2409.70	3d	Fe II	224	2409.708	UV	Fe II	164			2414.080	UV
2409.95	1H	Fe I?		2409.975	43	2414.33	3	Fe I	68	2414.318	29
2410.55	8W	Fe II	2	2410.521	UV	2414.46	5	Co I	6	2414.458	UV
2411.08	8W	Fe II	2	2411.062	UV	2414.94	3				
2411.33	1	Ti I	11	2411.358	58	2415.06	4 W	Fe II	181	2415.068	UV
2411.55	4	Fe I		2411.558	29	2415.10					
		Ti I	11	2411.568	58	2415.14					
2411.61	5	Co I	6	2411.618	UV	2415.29	5	Co I	6	2415.29	UV
						Co I	5			2415.32	UV
2411.72	2	Fe I		2411.738	29	2415.51	1	SiO	(0-1)	2415.504	30
2411.79	1h	Fe II		2411.810	23	2415.68	4	-SiO	(0-1)	2415.698	30
2411.96	4w	Fe I	67	2411.968	29	2415.79	3w	Fe II	130	2415.776	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2415.99	3	Fe II Co II		2415.967 2415.991	23 18	2418.57	1	SiO	(0-1)	2418.581	30
2416.13	4	Ni II	20	2416.134	52	2418.72	3	Fe II Fe II	364	2418.702 2418.702	UV 23
2416.22	2	Co II Fe I		2416.220 2416.230	18 43	2418.78	4 _w	Fe I		2418.781	43
2416.36	1 _w	Mn II SiO	37 (0-1)	2416.347 2416.349	19 30	2418.96	3	SiO?	(0-1)	2418.922	30
2416.43	2	Cr II Fe II	235 396	2416.40 2416.457	UV UV	2419.06	4	Fe I	66	2419.063	7
2416.60	1	SiO	(0-1)	2416.602	30	2419.12	4	Co I		2419.122	UV
2416.70	3	Fe II	286	2416.705	UV	2419.26	5	Fe I		2419.236	29
2416.88	4	Co II	16	2416.901	18	2419.31	6	Ni I Co I	7	2419.310 2419.324	UV 50
2416.94	1					2419.40	5 _w	Zr II ICr II	24 43	2419.37 2419.38	UV 27
2417.04	2	Co I		2417.045	UV	2419.71	3				
2417.13	1	SiO	(0-1)	2417.116	30	2419.82	1	Co I	59	2419.828	UV
2417.19	2					2419.88	5	Fe I Fe II	68 180	2419.878 2419.892	7 UV
2417.31	3	Co I Vd I	23	2417.329 2417.351	UV UV	2419.94	1	Cr I?	34	2419.98	UV
2417.35	3	Ge I	8	2417.367	25	2420.02	3	Fe II	396	2419.998	UV
2417.48	4	Fe I	105	2417.490	UV	2420.10	3	ICr II Mn I	43 34	2420.11 2420.110	UV UV
2417.65	5	Co II	7	2417.664	18	2420.22	4	Si I	86.01	2420.24	37
2417.80	5 _D	Fe		2417.821	7	2420.39	4	IFe I Mn I	64 33	2420.396 2420.403	7 4
2417.85		Fe II	244	2417.859	UV	2420.47	2 _h				
2418.02	3	SiO- Fe?	(0-1)	2417.990 2418.029	30 7	2420.53	4				
2418.16	3	Fe II		2418.146	10	2420.60	4				
2418.37	3 _h	Ti I	11	2418.362	58	2420.73	4 _d	Co II		2420.730	18
2418.44	2	Fe II	396	2418.440	UV	2420.94	2	Fe I?		2420.923	51
2418.47	1 _h	Co II		2418.470	18	2421.00	2				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2421.09	4h	Vd I IFe I	23	2421.058 2421.089	UV 43	2424.02	5	Ni I	30	2424.027	UV
2421.22	6	Ni I	6	2421.223	UV	2424.15	6	Fe II	180	2424.141	UV
2421.27	4d	Mn I Mn I— Ti I	34 11	2421.254 2421.254 2421.296	4 4 58	2424.25	3	ITi I Mn I	11 34	2424.247 2424.260	58 UV
2421.35	1	Fe I		2421.332	43	2424.39	5	Fe II	149	2424.380	UV
2421.72	3W	Cr I?		2421.71	28	2424.50	2				
2421.82	2W	Fe I	67	2421.836	43	2424.60	5	Fe II Fe II	180 301	2424.585 2424.585	UV UV
2421.92	4	Fe II	116	2421.898	UV	2424.65	4				
2422.21	3	Yt II	2	2422.22	UV	2424.77	3	SiO?—	(0—1)	2424.766	30
2422.49	3W					2424.93	6w	Co I	5	2424.932	UV
2422.56	4	Co I	123	2422.568	UV	2425.06	3w	Fe I?		2425.048	43
2422.68	5	Fe II	301	2422.688	UV	2425.13	2				
2422.93	4	Fe II	115	2422.932	UV	2425.19	2	Cr II	43	2425.21	UV
2423.02	4					2425.32	1	SiO	(0—1)	2425.326	30
2423.08	5	Fe I Fe I	67 68	2423.089 2423.106	7 7	2425.36	5	Fe II	210	2425.362	UV
2423.20	5	Fe II	301	2423.204	UV	2425.42	4				
2423.33	5	Ni I	5	2423.322	UV	2425.58	2	Co I	59	2425.593	UV
2423.38	3	Fe II		2423.357	10	2425.61	2				
2423.48	4	Fe II	388	2423.500	UV	2425.64	3	Cr II	43	2425.66	UV
2423.59	6D					2425.68	4	Fe II	224	2425.677	UV
2423.63		Co II Ni I	7 11	2423.625 2423.653	18 UV	2425.81	4	SiO— SiO	(0—1) (0—1)	2425.788 2425.835	30 30
2423.73	1					2425.92	4	Fe II	130	2425.904	UV
2423.81	1	SiO	(0—1)	2423.795	30	2426.10	3d	Fe I— Co II		2426.077 2426.122	7 18
2423.90	3	Fe II	313	2423.919	UV	2426.32	4	Fe I		2426.313	29
						2426.45	3				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2426.56	3					2428.87	4	Fe I	157	2428.866	43
2426.68	1	Cr I?	84	2426.66	UV	2428.95	1	Fe II	375	2428.970	UV
2426.77	1					2429.04	4	Fe II	301	2429.034	UV
2426.88	1	SiO	(0-1)	2426.858	30	2429.09	3	Ni I	55	2429.092	UV
2426.91	1	SiO	(0-1)	2426.883	30	2429.14	3	Fe II	385	2429.154	23
2427.00	2	Co I		2426.997	UV	2429.22	3	Co I Mn I	7 33	2429.226 2429.233	UV 4
2427.13	1	Fe I		2427.129	43	2429.40	6	Fe II	148	2429.382	UV
2427.19	3	Fe II	114	2427.197	UV	2429.46	2	Fe I	68	2429.431	29
2427.29	2	Fe II Vd II	41	2427.282 2427.316	23 UV	2429.51	3	Fe II	180	2429.497	UV
2427.40	4	Mn II— SiO	74 (0-1)	2427.379 2427.427	19 30	2429.74	1	SiO— SiO	(0-1) (0-1)	2429.716 2429.744	30 30
2427.67	3					2429.79	2				
2427.72	2	Mn II	74	2427.719	19	2429.82	5	Fe I Fe II	68	2429.815 2429.849	7 10
2427.83	2					2430.09	6w	Fe II	180	2430.073	UV
2427.94	2	Mn II Au I	74 1	2427.939 2427.95 ‡	19 UV	2430.19	4	Fe II Fe II Fe I	301 301 157	2430.184 2430.184 2430.192	UV UV 29
2428.07	5w	Fe II	114	2428.079	UV	2430.38	1w	SiO Fe I Mn I	(0-1) 33	2430.360 2430.361 2430.395	30 43 4
2428.29	6	Fe II Co II	301 7	2428.286 2428.295	UV 18	2430.46	1				
2428.34	5	—Ti I	11	2428.348	58	2430.58	3				
2428.38	4	Fe II	300	2428.367	UV	2430.86	4	Fe II	375	2430.864	23
2428.45	2	Mn I— Fe	34	2428.423 2428.455	UV 7	2430.90	3	—SiO	(0-1)	2430.929	30
2428.54	3	SiO SiO	(0-1) (0-1)	2428.546 2428.546	30 30	2431.01	5	Fe II? Fe I		2431.000 2431.025	23 7
2428.58	4	Co I		2428.596	50	2431.23	1	Fe II	375	2431.236	UV
2428.66	1	Fe		2428.641	7						
2428.80	5	Fe II	301	2428.795	UV						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2431.29	4	Fe I?		2431.305	51	2434.07	2	Fe II	375	2434.052	UV
2431.55	3 <i>H</i>	Mn I	34	2431.520	UV			Ti I	11	2434.067	58
		SiO	(0-1)	2431.557	30			Mn I	33	2434.071	4
		Ni II	49	2431.561	52	2434.23	3	Mn I	33	2434.208	4
2431.78	3 <i>W</i>	Ti I?		2431.772	58			Fe I	384	2434.229	UV
2432.21	} 6 <i>D</i>	Co I	5	2432.213	UV	2434.31	3	Fe I		2434.299	43
		Ni I		2432.22	48	2434.41	4	Fe II	301	2434.398	UV
2432.24		Fe II	180	2432.259	UV			Ni I	53	2434.412	UV
2432.32	3	Fe I	106	2432.332	29	2434.49	2				
2432.40	2	Fe I	64	2432.402	29	2434.64	3	Fe II	301	2434.645	UV
2432.51	3 <i>w</i>	Co II		2432.530	18	2434.68	4				
2432.59	1					2434.72	5	Fe II	321	2434.733	23
2432.69	3	Fe II	321	2432.701	23	2434.82	1	Fe II	375	2434.822	UV
2432.78	2					2434.93	4	Fe II	180	2434.947	UV
2432.84	1	SiO	(0-1)	2432.850	30	2434.98	3	Fe II	383	2434.988	UV
2432.87	5	Fe II	321	2432.867	23	2435.15	7 <i>W</i>	Si I	45	2435.154	37
2432.98	1	SiO	(0-1)	2432.958	30	2435.34	1 <i>w</i>	Fe I		2435.345	43
		Vd II	41	2432.976	UV	2435.51	1 <i>w</i>	Mn I	33	2435.511	4
2433.06	4 <i>h</i>	Fe II	384	2433.050	UV			Vd I	23	2435.518	UV
		Fe I	68	2433.056	29	2435.81	4	Fe II	164	2435.816	UV
2433.20	3	Cr II	202	2433.20	UV			Co I		2435.823	50
		Ti I	10	2433.211	58	2435.86	4	Fe I		2435.870	7
2433.31	2					2436.06	3	Fe I		2436.072	29
2433.42	1					2436.20	4	Fe II	209	2436.222	UV
2433.48	4	Fe II	164	2433.495	23	2436.34	4	Fe I		2436.346	7
2433.54	4 <i>d</i>	Ni II	19	2433.556	52	2436.42	2	Fe II	360	2436.413	23
		Fe II	359	2433.571	23			Co I		2436.435	UV
2433.90	3	Fe I		2433.894	43	2436.65	5 <i>d</i>	Fe II	384	2436.615	UV
2433.95	2							Co I	5	2436.663	UV
						2436.78	2				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2436.85	3					2440.09	5d	Pt I— Fe I	2 157	2440.08 2440.109	UV 7
2436.98	4	Co II Fe II Fe II	7 375 375	2436.980 2436.987 2437.100	18 UV UV	2440.16	4	Ti II	21	2440.178	56
2437.16	} 5d	Fe II	210	2437.157	UV	2440.34	3	Fe I		2440.335	29
2437.20		Fe I		2437.203	7	2440.42	4w	Fe II	300	2440.416	UV
2437.25	4	Fe II	313	2437.256	UV	2440.68	3				
2437.37	2	Mn II	74	2437.366	19	2440.99	4	Ti I	10	2440.976	58
2437.63	2	Fe II	375	2437.657	23	2441.04	4	Co I	132	2441.040	UV
2437.84	4	Mn II	74	2437.844	19	2441.14	3	Fe II	395	2441.133	UV
2437.88	5	Ni II	19	2437.892	52	2441.42	1				
2438.17	4	Fe I Mn II	62 74	2438.182 2438.187	7 19	2441.54 2441.59	} 4d	Fe II	210	2441.548	UV
2438.30	3	Ti I	10	2438.285	58	2441.62		Cu I	1	2441.637	UV
2438.46	2h	Cr II	202	2438.46	UV	2441.65	} 4d	Ni I	31	2441.665	UV
2438.57	2					2441.81		Ni I	31	2441.817	UV
2438.76	5w	Si I	2	2438.767	37	2441.99	1	Zr II	23	2441.97	UV
2439.03	5	Co I	5	2439.038	UV	2442.05	1				
2439.17	3	Fe I	64	2439.170	7	2442.11	1	Fe		2442.130	7
2439.30	5	Fe II	209	2439.301	UV	2442.23	1w				
2439.35	3					2442.57	5W	Fe I	157	2442.567	UV
2439.41	1					2442.64	3	Co II		2442.631	18
2439.50	1	Co I		2439.495	UV	2442.68	1	Ti II	21	2442.690	56
2439.62	5	Fe I		2439.630	7	2442.77	1				
2439.74	5	Fe I	157	2439.744	7	2442.87	2	Co I		2442.888	UV
2439.83	3	Fe I— Fe II	66 375	2439.803 2439.860	43 UV	2443.01	3	Fe II		2443.027	10
						2443.16	1h				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2443.37	5w	Si I	2	2443.364	37	2447.31	4	Fe II	299	2447.320	23
2443.54	2	Co I	57	2443.548	UV	2447.57	2	Fe II	299	2447.560	23
2443.78	4	Co II	16	2443.770	18	2447.71	6w	I Fe I Fe II	9 320	2447.709 2447.753	7 UV
2443.87	5	Fe II Fe I	375 63	2443.842 2443.872	UV 7	2447.83	2h	Co II Fe I?		2447.831 2447.850	18 43
2444.11	3					2448.29	3				
2444.29	2	Fe II	375	2444.274	UV	2448.39	4w	Fe I		2448.388	51
2444.52	5w	Fe II	148	2444.515	UV	2448.57	3	Fe I		2448.570	29
2444.71	2					2448.72	2d	-Fe II	222	2448.731	UV
2444.75	3					2448.84	4	Fe I		2448.826	29
2444.89	3	Fe I		2444.905	29	2448.98	1				
2444.99	1	Vd II	92	2444.967	UV	2449.04	3				
2445.10	4	Fe II	375	2445.108	23	2449.16	5	Co II Fe II	7 129	2449.158 2449.185	18 UV
2445.21	4	Fe I	63	2445.212	7	2449.28	3	Fe II	128	2449.272	UV
2445.34	1					2449.54	1				
2445.59	5w	Fe II	148	2445.569	UV	2449.61	3d	Mg II Cr II	5 190	2449.590 2449.63	44 UV
2446.02	3	Co II		2446.035	18	2449.72	4h	Fe II	34	2449.739	UV
2446.11	4	I Fe II Ti I	300 10	2446.103 2446.126	UV 58	2449.83	2	Zr II	23	2449.83	UV
2446.22	3	Fe II	209	2446.203	UV	2449.98	5d	Cr II Fe II Co II	190 300 16	2449.95 2449.961 2450.001	UV UV 18
2446.43	4	Fe II	375	2446.405	UV	2450.15	1	Fe II	375	2450.134	UV
2446.49	5w	Fe II	164	2446.462	UV	2450.20	4	Fe II	300	2450.196	UV
2446.72	1H	Vd II	41	2446.697	UV	2450.44	5	Ti II Fe I Ni I	21 7 57	2450.44 2450.444 2450.465	UV 7 UV
2446.93	2W	Cr II-	190	2446.91	UV						
2447.20	4	Fe II	300	2447.203	UV						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2450.55	2	Fe I		2450.556	43	2453.95	4w	Fe II	375	2453.935	UV
2450.60	1	Vd II?	92	2450.619	UV	2453.98		Fe II	401	2453.973	UV
2450.76	1w	Vd II	41	2450.734	UV			Ni I	6	2453.984	UV
2450.97	4	Ni I		2450.975	UV	2454.09	2	Cr II	74	2454.06	UV
2451.10	4	Fe II	34	2451.106	UV	2454.16	2d	Fe II	222	2454.158	UV
2451.23	5	Fe II	209	2451.208	UV	2454.40	2	Fe I		2454.399	29
2451.38	5	Fe II Fe II Fe I	114 300	2451.354 2451.354 2451.384	UV UV 29	2454.58	4	Fe II	320	2454.574	UV
2451.68	5	Fe I		2451.675	7	2454.72	1h				
2452.12	6w	Si I	2	2452.118	37	2454.82	2d				
2452.33	3w	Fe I		2452.345	29	2454.96	1W				
2452.47	1	Mn II	74	2452.486	19	2455.12	1				
2452.58	3	Co II Fe I	157	2452.561 2452.590	18 UV	2455.20	2h				
2452.80	2					2455.54	4	Ni II? Ru II	18 41	2455.519 2455.53	52 UV
2452.84	4					2455.58	5	Fe		2455.567	7
2452.94	2d	Fe II Fe I	300	2452.916 2452.965	UV 29	2455.72	1	Fe II	395	2455.721	UV
2453.13	1w	Mn II	74	2453.133	19	2455.85	2				
2453.17	2	Fe II	385	2453.165	23	2455.89	1w	Fe II	384	2455.892	UV
2453.37	2	Vd II— Fe I	92 64	2453.346 2453.385	UV 43	2455.98	1w	Ti II	2	2455.99	38
2453.47	4	Fe I	62	2453.476	7	2456.20	4	Fe		2456.189	7
2453.56	3	Fe I	157	2453.568	29	2456.56	3w	Ru II	41	2456.57	UV
2453.65	1	Mn II	74	2453.620	19	2456.64	1	Fe II	320	2456.641	UV
2453.73	1	Fe II	375	2453.747	UV	2456.70	3	Fe I	106	2456.704	29
2453.80	3W	Fe II	163	2453.794	UV	2456.83	3	Fe II	209	2456.816	UV
						2457.08	2	Fe II	269	2457.104	UV
						2457.18	1w				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2457.44	1h	Zr II Vd II	23 91	2457.43 2457.446	UV UV	2460.43	3d	Cr II— Fe II	168 395	2460.42 2460.453	UV UV
2457.60	6	Fe I	62	2457.598	7	2460.56	2				
2457.69	1					2460.65	1	Fe II	359	2460.644	23
2457.80	1h	Fe II Ti I	299 9	2457.785 2457.824	23 58	2460.74	1				
2457.90	1w					2460.80	4	Co I	5	2460.800	UV
2458.00	1W	Ti I?	9	2458.032	58	2460.90	1	Mn I	32	2460.887	UV
2458.12	2					2461.01	} 4d	Mn I	32	2461.011	UV
2458.15	1					2461.05		Fe		2461.059	7
2458.32	1W	Vd II	39	2458.288	UV	2461.20	2w				
2458.56	5w	Fe I	59	2458.568	7	2461.29	5	Fe II	209	2461.282	UV
2458.70	2					2461.33	3				
2458.78	4	Fe II	209	2458.782	UV	2461.54	1H				
2458.96	3	Fe II	299	2458.964	23	2461.68	4	Fe II	163	2461.667	UV
2459.11	3h	Fe II Fe II	163 312	2459.097 2459.097	UV UV	2461.77	1				
2459.33	2	Fe II Vd II	382 92	2459.296 2459.358	UV UV	2461.86	5	Fe II	209	2461.855	UV
2459.47	1	Co II		2459.452	18	2462.18	7	Fe I	9	2462.181	7
2459.61	1W					2462.33	4	Fe II Cr II	395 168	2462.325 2462.35	UV UV
2459.71	1	Mn I	32	2459.694	4	2462.65	8W	Fe I	9	2462.647	7
2459.90	2W					2462.79	3	Mn I	32	2462.776	UV
2460.08	3	Fe I		2460.069	29	2462.97	4h	IFe I Mn I	 32	2462.967 2463.005	7 UV
2460.17	3d	Fe II Co I	401	2460.171 2460.195	UV 50	2463.29	5	Fe II	208	2463.280	UV
2460.25	2	Fe I	64	2460.258	43	2463.40	2	Ti II	2	2463.41	38
2460.29	4h	Fe I		2460.299	7	2463.60	3				
						2463.63	4				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2463.73	5	Fe II	129	2463.726	UV	2466.69	5D	Fe II—	179	2466.670	UV
{		Fe II	162	2463.726	UV	2466.82	5d	Fe II	179	2466.811	23
		Fe I	65	2463.730	7						
2463.78	3	Co I	7	2463.776	UV	2466.89	2	Fe I	61	2466.898	43
2463.89	3	Fe II	385	2463.908	23	2466.96	3	Ni I	56	2466.960	UV
2464.01	5	Fe II	208	2464.007	UV	2467.04	1h	Co II		2467.047	18
2464.19	5	Co II	15	2464.201	18	2467.16	2h	Cr I	33	2467.14	UV
2464.35	2	Fe I		2464.349	29	2467.28	2w				
2464.45	1w					2467.43	3W	Pt I	1	2467.42	UV
2464.65	4d	Co I—	7	2464.615	UV	2467.57	5	Fe I		2467.567	7
2464.75	1					2467.72	6w	Co I	5	2467.685	UV
2464.90	5	Fe II	208	2464.903	UV			Fe I	62	2467.732	7
								Fe II	387	2467.732	UV
2465.05	2h					2467.99	5h	Fe II		2468.000	10
2465.15	{	Fe I—	62	2465.149	7	2468.18	4	Fe II	332	2468.194	23
2465.20		Fe II	148	2465.194	UV	2468.25	4	Gd II?—		2468.22	49
2465.25	3w	Ni I	8	2465.263	UV	{	2468.29	Fe II	145	2468.292	UV
		Vd II	92	2465.270	UV			Fe II	163	2468.292	UV
2465.38	2w	Zr II—	23	2465.37	UV	2468.37	2	Ti I	9	2468.359	58
2465.49	3	Ti I?		2465.478	58	2468.54	3	Fe II	113	2468.561	UV
2465.56	1					2468.72	2				
2465.80	3W	Cr II—	281	2465.78	UV	2468.87	6W	Fe I	59	2468.880	7
2465.91	5	Fe II	208	2465.911	UV	2468.99	2	Fe I	64	2469.003	43
2466.06	3d	—Fe I		2466.093	29	2469.13	3d	Cr II	92	2469.13	UV
								Ti II	2	2469.146	56
2466.22	1	Mn II	64	2466.214	19	2469.20	1				
		Cr II?	74	2466.22	UV						
2466.30	4					2469.37	4	Fe II	162	2469.373	UV
								Mn I	31	2469.407	UV
2466.38	3	Fe I		2466.348	29	2469.50	5	Fe II	299	2469.512	23
2466.55	4	Fe I	65	2466.530	29	2469.66	4	Fe I	10	2469.666	29

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2469.77	2					2472.91	8W	Fe I	9	2472.875	UV
2469.83	1	Fe II	358	2469.823	23			Fe I	9	2472.910	UV
2469.88	2	Fe I?		2469.90	51			Co I	57	2472.922	UV
2469.94	4					2473.15	6	Ni II	19	2473.148	52
2469.99	1							Fe I	8	2473.156	7
2470.07	2					2473.33	5	Fe II	148	2473.314	23
2470.26	5	Co I	57	2470.270	UV	2473.40	3				
2470.40	5	Fe II	208	2470.406	UV	2473.90	3w	Co I	5	2473.901	UV
2470.67	5	Fe II	179	2470.661	UV	2474.07	2	Fe II		2474.073	10
2470.76	4	Fe II	223	2470.752	UV			Cr I	32	2474.08	UV
2470.82	2w	Cr II	92	2470.81	UV	2474.19	3	Ti II	2	2474.22	UV
2470.96	5	Fe I	63	2470.966	7	2474.30	1	Mg II		2474.314	38
		Fe I	63	2470.966	7	2474.46	3	Fe		2474.442	7
		Ti I	9	2470.987	58	2474.56	1	Cr I	32	2474.55	UV
2471.27	2w	Fe II	394	2471.276	UV			Mg II		2474.584	38
2471.38	3					2474.79	5w	Fe II	208	2474.762	UV
2471.54	3w							Fe I	62	2474.814	7
2471.65	3w	Fe II	162	2471.674	UV	2474.96	1	Mn II?		2474.967	19
2471.76	1					2475.02	4	Fe I		2475.019	7
2472.06	5	Ni I	7	2472.065	UV	2475.13	1W	Ir I?	1	2475.122	UV
		Fe II	162	2472.075	UV			Fe II	395	2475.125	UV
2472.24	4	Ni I	7	2472.224	UV	2475.29	1w				
2472.35	5	Fe I	63	2472.336	7	2475.36	1				
		Fe I	59	2472.352	7	2475.47	3	Vd II	71	2475.451	UV
2472.43	5	Fe II	179	2472.426	UV			Fe I		2475.466	29
2472.61	4	Fe II— Fe	395	2472.610 2472.643	UV 7	2475.54	2h	Fe II	395	2475.548	UV
						2475.70	2	Cr II	92	2475.69	UV
						2475.75	3	Fe I		2475.758	29
						2475.91	3H				
						2476.03	4	Fe?		2476.031	7

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2476.26	4	Fe II	163	2476.264	UV	2479.63	4	Fe I	59	2479.630	7
2476.36	1	Fe II	385	2476.392	23	2479.77	7 W	Fe I	9	2479.776	7
2476.47	4	Fe II? Fe I	386	2476.437 2476.471	UV 7	2479.99	1 w				
2476.65	4D	Co I Fe I	56 62	2476.640 2476.657	UV 7	2480.16	6 w	Fe II	179	2480.155	UV
2476.87	4	IFe I INi I Cr II	65 3 145	2476.865 2476.875 2476.90	7 UV UV	2480.38	4	Fe I		2480.393	29
						2480.74	4	Fe I		2480.732	29
2477.03	1h					2481.04	4	Fe II	243	2481.044	UV
2477.23	3	Ti II	2	2477.21	UV	2481.22	2	Cr I	32	2481.23	UV
2477.30	4D	Fe I?		2477.304	29	2481.34	1h	Zr II	14	2481.35	UV
2477.34		Fe II	162	2477.342	UV	2481.48	2h	Ti II	10	2481.49	UV
2477.49	4	Fe II	113	2477.487	UV	2481.58	4D	Fe II Fe II	112 331	2481.576 2481.576	UV UV
2477.85	3 W					2481.90	3	Ni I	28	2481.917	38
2478.12	4	Fe II	224	2478.115	UV	2481.99	2 W				
2478.19	5	Fe II	149	2478.206	UV	2482.12	5	Fe II	161	2482.117	UV
2478.31	3	Fe I		2478.300	29	2482.33	4	Vd II Fe II	39 358	2482.307 2482.320	UV 23
2478.45	4	Fe II	161	2478.449	UV	2482.41	3				
2478.56	5 W	C I Fe II	61 179	2478.561 2478.568	37 UV	2482.50	3 w	Cr II	92	2482.48	UV
2478.69	3	Ti II	2	2478.68	47	2482.66	6	Fe II	207	2482.654	UV
2478.77	3	Ti II	2	2478.77	47	2482.76	2	Fe		2482.752	7
2478.92	2	Ru II	41	2478.93	UV	2482.80	3				
2479.02	3	Vd II	71	2479.043	UV	2482.87	4	Fe II—	400	2482.869	UV
2479.14	1	Cr I	32	2479.14	UV	2483.06	3	Vd II	71	2483.064	UV
2479.28	3 w	Fe II	208	2479.276	UV	2483.15	3				
2479.48	5D	IFe I Vd II	65 71	2479.480 2479.518	7 UV	2483.28	8 W	Fe I	9	2483.271	7
						2483.43	3				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2483.53	5	Fe I	62	2483.533	7	2487.37	6d	Fe II— Fe I	385 10	2487.356 2487.370	UV 7
2483.72	3	Fe II	331	2483.721	UV	2487.60	2				
2483.82	2h	Cr II	75	2483.79	UV	2487.76	3				
2484.02	3	Ni I	50	2484.028	UV	2487.85	3				
2484.21	5W	I Fe I Ni II I Fe II	9 61 243	2484.185 2484.204 2484.243	7 52 UV	2488.14	8W	Fe I	9	2488.143	7
2484.43	2	Fe II	400	2484.442	UV	2488.44	3h	Co I	7	2488.461	UV
2484.52	4d	Fe I		2484.530	29	2488.70	1				
2484.57		Fe II	243	2484.553	UV	2488.94	5	Fe I	164	2488.945	7
2484.98	3	Fe I	62	2484.999	43	2489.07	3	Fe II?		2489.074	7
2485.06	4	Fe II	34	2485.076	UV	2489.18	2				
2485.12	4	Mn I?— I Fe		2485.114 2485.139	4 7	2489.28	2	Cr II	92	2489.28	UV
2485.25	4	Fe		2485.264	7	2489.50	6	Fe II Ni I	161 27	2489.485 2489.507	UV UV
2485.35	3	Co II	14	2485.362	18	2489.76	6	Fe I	9	2489.750	7
2485.43	2	Fe I		2485.435	29	2489.83	6	Fe II	207	2489.826	UV
2485.74	2					2489.90	5	Fe I	65	2489.913	7
2485.82	1h	Cu II	92	2485.792	25	2489.97	3				
2485.85	1h					2490.65	7W	Fe I	9	2490.644	7
2485.98	5	Fe I	59	2485.990	7	2490.84	5	Fe I— Fe II	179	2490.829 2490.856	43 UV
2486.12	2	Mn II?		2486.158	19	2491.15	6W	Fe I	9	2491.155	7
2486.29	4	Cr II	92	2486.29	UV	2491.40	4W	Fe II	207	2491.392	UV
2486.36	6	Fe II Fe I	208 8	2486.343 2486.373	UV 7	2491.47	4	Fe		2491.466	7
2486.43	4	Co II	15	2486.436	18	2491.60	2h				
2486.69	5	Fe I	62	2486.691	7	2491.66	2w	Fe I		2491.673	7
2487.07	4	Fe I	62	2487.066	7	2491.98	4w	Fe I	163	2491.982	7

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2492.14	3	Cu I	1	2492.146	UV	2494.78	4	Fe I		2494.781	7
2492.22	4	Fe I	164	2492.229	7	2494.90	1	Fe II	382	2494.893	UV
2492.35	4 <i>W</i>	Fe II	243	2492.341	UV	2495.07	2	Cr I	31	2495.08	UV
2492.46	1 <i>W</i>					2495.23	4 <i>W</i>	Fe II Fe I	393	2495.233 2495.247	UV 51
2492.56	2	Cr I	31	2492.57	UV	2495.35	2 <i>h</i>				
2492.60	3	Cr II	234	2492.62	UV	2495.54	4	Co I	56	2495.551	UV
2492.66	3 <i>w</i>	Fe I	63	2492.630	7	2495.71	2				
2492.81	3	Fe I	59	2492.822	29	2495.83	3				
2492.86	2 <i>w</i>	Cr II	234	2492.86	UV	2495.86	5	Fe II Fe I	57	2495.860 2495.871	23 7
2493.19	6 <i>W</i>	Fe II Fe II	161 207	2493.174 2493.174	UV UV	2496.06	4 <i>W</i>	Fe I?		2496.05	51
2493.28	7 <i>W</i>	II Fe II Cr II	161 93	2493.269 2493.28	UV 27	2496.20	3				
2493.48	1	Zn I?		2493.455	38	2496.33	4 <i>d</i>	Cr I—	31	2496.30	UV
2493.56	1	Vd II	5	2493.576	UV	2496.45	2 <i>h</i>	Cr II	145	2496.44	UV
2493.69	3 <i>w</i>					2496.53	6	Fe I	59	2496.533	7
2493.78	3	Fe		2493.751	7	2496.73	4	Co I	57	2496.713	UV
2493.89	2 <i>w</i>	Fe II	400	2493.880	UV	2496.77	4	Fe		2496.792	7
2494.00	6	Fe I Fe I	62 63	2494.000 2494.000	7 7	2496.86	3				
2494.12	5	Fe II	161	2494.111	UV	2496.99	4	Fe I	164	2496.991	7
2494.25	5	Fe I	57	2494.252	7	2497.30	3	Fe II	208	2497.300	UV
2494.35	1 <i>w</i>					2497.48	1	Co II		2497.486	18
2494.40	2	Mn I	16	2494.391	UV	2497.55	3				
2494.50	3	Fe I	61	2494.509	7	2497.71	6	Fe II Fe II	128 242	2497.709 2497.709	UV UV
2494.66	2 <i>h</i>					2497.83	5 <i>h</i>	Fe II Fe II	175 207	2497.817 2497.817	UV UV
2494.74	3	Be I Co I	3	2494.728 2494.730	22 50	2497.98	1	Ge I	2	2497.962	25

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2498.04	3					2502.07	2				
2498.12	3					2502.22	2				
2498.20	4	Fe		2498.203	7	2502.40	4	Fe II	207	2502.388	UV
2498.34	4	Fe II		2498.361	10	2502.50	4	Fe I		2502.491	7
2498.69	3	Fe I		2498.698	29	2502.63	3				
2498.80	6d	Cr II Co II	93	2498.80 2498.823	UV 18	2502.78	2w	Fe II		2502.762	10
2498.89	7W	Fe II Fe I	161 8	2498.897 2498.898	UV 7	2503.03	2W	Vd II	21	2503.018	UV
2499.00	4	Mn II	45	2499.003	19	2503.17	1w				
2499.22	3w	-Vd I?	17	2499.244	UV	2503.33	5	Fe II	206	2503.323	UV
2499.28	3w					2503.49	5	Fe I	164	2503.492	7
2499.43	2w					2503.56	5	Fe II Fe II	161 175	2503.560 2503.560	UV UV
2499.63	3					2503.87	4	Fe II	285	2503.870	UV
2499.70	3	Fe I	104	2499.693	29	2504.10	2	Fe I		2504.101	29
2499.84	2	Cr I	31	2499.84	UV	2504.31	3	Cr I	31	2504.31	UV
2500.05	1w					2504.52	4	Co I	55	2504.518	UV
2500.09	1w					2504.63	2	Fe I		2504.635	29
2500.23	4					2505.02	4	Cr I Fe I	69 163	2505.00 2505.011	UV 7
2500.49	5h	Co I		2500.494	50	2505.22	4w	Fe II	33	2505.217	UV
2500.65	4					2505.37	1				
2500.90	5W	Fe II	357	2500.919	23	2505.47	5w	Fe I		2505.485	7
2501.13	7W	Fe I	7	2501.132	7	2505.63	5	Fe I		2505.627	UV
2501.33	3	Fe II	400	2501.351	UV	2505.85	2	INi II Cr II	48 200	2505.843 2505.86	52 UV
2501.42	3	Fe I	59	2501.422	43	2506.01	2				
2501.48	3	Cr II	73	2501.48	UV	2506.10	4	Ni II IIFe II	61 207	2506.091 2506.091	52 UV
2501.69	6W	Fe I	56	2501.694	7						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2506.19	2	Vd II	21	2506.215	UV	2509.79	2	Fe I?		2509.800	43
2506.28	1	Cu II	92	2506.273	25	2509.87	4	Fe II	363	2509.875	UV
2506.46	3	Fe II Co II	123 15	2506.429 2506.462	UV 18	2510.02	2w				
2506.57	2	Fe I	163	2506.574	7	2510.12	2	Fe II	400	2510.121	UV
2506.91	8W	Si I	1	2506.897	37	2510.23	2	Cr II	200	2510.24	UV
2507.04	4	Fe II	207	2507.014	UV	2510.30	2				
2507.35	3	Cr I	69	2507.32	UV	2510.39	1	Fe II		2510.394	10
2507.42	2	Fe I?		2507.40	51	2510.50	2	Cr I—	29	2510.49	UV
2507.52	2					2510.54	3	Fe II	112	2510.565	UV
2507.60	2h	Mn II Fe II	45 363	2507.598 2507.607	UV UV	2510.67	2	Mn II		2510.655	19
2507.69	2	Co I Fe II	56 363	2507.678 2507.695	UV UV	2510.84	7W	Fe I	7	2510.835	7
						2510.90	3	INi II Ti II	18 4	2510.871 2510.903	52 56
2507.76	2	Fe? Vd I Vd I	 17 19	2507.739 2507.777 2507.777	7 UV UV	2511.01	4	Co I	56	2511.019	UV
						2511.17	2	Co II		2511.159	18
						2511.37	4	Fe II	33	2511.375	UV
2507.92	5W	Fe I	59	2507.900	7	2511.76	5H	Fe II	161	2511.759	UV
2508.11	3	Cr I	30	2508.11	UV	2511.94	2D	Fe II Vd I Cr I	 17 69	2511.910 2511.940 2511.96	23 UV UV
2508.26	2										
2508.35	2	Fe II		2508.338	23						
2508.49	3					2512.07	2	Co II C II	 14	2512.062 2512.065	18 37
2508.75	5	Fe I	63	2508.753	7	2512.20	2	Cr II?	167	2512.22	UV
2508.94	4	Fe I	59	2508.948	29	2512.27	5	Fe I	55	2512.275	7
2509.12	5	Fe II	242	2509.117	UV	2512.37	5	Fe I	8	2512.365	7
2509.27	4					2512.52	3	Fe II	343	2512.513	UV
2509.39	4	Fe I		2509.390	29	2512.73	2	Fe II	129	2512.727	UV
2509.62	1					2512.90	2w	Co I	113	2512.900	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2512.97	3	Fe I		2512.984	43	2517.22	3h	Fe II	207	2517.211	UV
2513.13	3h	Co I? Fe II	363	2513.119 2513.155	50 UV	2517.42	5	Ti II	4	2517.448	UV
2513.32	4	Fe I		2513.328	UV	2517.59	1w	Cr I	29	2517.57	UV
2513.39	1	Fe II	207	2513.372	UV	2517.65	6	Fe I	59	2517.662	7
2513.49	4	Fe		2513.498	7	2517.81	3W	Co I	56	2517.792	UV
2513.61	1h	Cr I	30	2513.62	UV	2518.10	7W	Fe I	7	2518.102	7
2513.75	2	Fe		2513.785	7	2518.32	2				
2513.85	3	Fe I	164	2513.849	7	2518.41	2w				
2514.31	8W	Si I	1	2514.316	37	2518.70	1	Cr I	30	2518.71	UV
2514.38	4	Fe II	285	2514.383	UV	2518.82	4	Fe I		2518.826	7
2514.55	3W	Fe		2514.569	7	2519.04	6	Fe II	268	2519.044	UV
2514.62	1	Ni II Vd II	61 21	2514.627 2514.633	52 UV	2519.20	8W	Si I	1	2519.202	37
2514.71	4	Fe		2514.709	7	2519.39	2	Fe II	222	2519.404	UV
2514.77	2					2519.50	3	Cr I	31	2519.51	UV
2514.92	4	Fe II Fe II	175 206	2514.912 2514.912	UV UV	2519.62	6w	Vd I IFe I	17 59	2519.622 2519.629	UV 7
2515.15	1	Vd I	18	2515.145	UV	2519.81	5d	Ti II Co II	4 15	2519.818 2519.820	56 18
2515.83	4	Fe I	104	2515.848	UV	2520.17	2W				
2516.10	9	Si I	1	2516.112†	37	2520.27	1W	Cr I? Fe II	31 363	2520.23 2520.267	UV UV
2516.25	3w	Fe I	57	2516.250	7	2520.33	1				
2516.56	4	Fe I	61	2516.570	7	2520.53	2h	Ti I Fe II	8 343	2520.534 2520.535	58 UV
2516.71	2	Mn II	45	2516.742	19	2520.66	4	Cr II IFe II	108 242	2520.65 2520.669	UV UV
2516.91	2	Cr I	30	2516.92	UV	2520.75	2	Fe II	175	2520.749	UV
2517.12	5	Fe I Fe II Vd I	56 147 19	2517.119 2517.124 2517.142	43 UV UV	2520.86	3	Fe?		2520.868	7

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2520.97	4	Fe I		2520.971	7	2525.37	5w	Fe II	159	2525.386	UV
2521.08	5	Fe II	268	2521.089	UV	2525.51	3w				
2521.36	5	Co I	3	2521.361	UV	2525.60	5	Ti II	4	2525.619	UV
2521.46	1	Fe II		2521.485	23	2525.72	1				
2521.62	3h					2525.86	3	Fe II	241	2525.858	23
2521.76	2	Fe I?		2521.762	43			Fe II	357	2525.858	23
2521.81	3	Fe II	330	2521.810	23	2525.92	2	Fe II	363	2525.933	UV
2521.91	5	Fe I	58	2521.918	7	2526.07	4	Fe II	159	2526.071	UV
2522.09	1					2526.21	3	Vd I	17	2526.213	UV
2522.19	4	Fe II	159	2522.189	UV	2526.29	5	Fe II	145	2526.292	UV
2522.49	5w	Fe I	57	2522.480	7	2526.40	1	Mg I?		2526.390	38
2522.63	1h					2526.60	1h	Cu II	92	2526.593	25
2522.85	8W	Fe I	7	2522.849	7	2526.81	3	Fe II	33	2526.837	UV
2523.14	4	Fe		2523.137	7	2527.14	4w	Fe II	159	2527.107	UV
2523.33	3	Fe		2523.323	7			Cr I	30	2527.11	UV
2523.45	1W	Fe II	363	2523.451	UV			Fe I		2527.16	UV
2523.66	5	Fe I		2523.662	7	2527.28	2	Fe I		2527.267	7
2523.93	2d	Cr II	199	2523.93	UV	2527.43	7W	Fe I	7	2527.435	7
		Vd II	38	2523.953	UV	2527.70	3	Fe II	329	2527.694	UV
		Vd II	50	2523.953	UV	2527.91	2	Vd II	50	2527.903	UV
2524.11	7W	Si I	1	2524.108	37	2528.04	2	Cr I	29	2528.02	UV
2524.28	6W	Fe I	7	2524.293	7			Ni I	51	2528.048	UV
2524.62	5D	Fe I		2524.602	7	2528.16	3	Fe		2528.172	7
		Ti II	4	2524.655	UV	2528.51	7W	Si I	1	2528.509	37
2524.99	6D	Co II	15	2524.974	18	2528.60	5	Co II	14	2528.615	18
		Fe I		2525.024	7	2528.70	1	Fe II	176	2528.676	UV
2525.10	3	Fe II	330	2525.114	23	2528.85	3	Vd II	50	2528.833	UV
2525.28	1W	Ni II	61	2525.296	52	2528.97	3	Co I	3	2528.968	UV

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THE SOLAR SPECTRUM 3088A-2095A FROM THE ECHELLE
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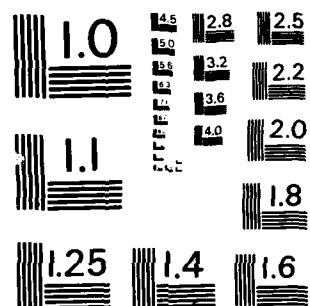
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The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2529.14	6W	Fe II Fe I	357 7	2529.078 2529.135	23 7	2532.07	3	Ni I	27	2532.076	UV
2529.22	3	Fe II	241	2529.221	UV	2532.17	3	Co I	56	2532.176	UV
2529.30	3	Fe I		2529.308	7	2532.27	3	Fe I		2532.269	29
2529.48	1	Cr II	9	2529.48	UV	2532.38	5	Si I	86	2532.381	37
2529.55	4	Fe II Fe II	145 177	2529.545 2529.545	UV UV	2532.46	1	Mg I Zr II	 7	2532.463 2532.47	38 UV
2529.73	3	Ti II	4	2529.74	UV	2532.78	1	Mn II	55	2532.781	19
2529.82	5W	Fe I	7	2529.836	7	2532.88	4D	Fe I	56	2532.875	7
2530.11	3	Co II Fe II Fe II Co I	27 178 363 56	2530.094 2530.103 2530.103 2530.134	18 UV UV UV	2532.93	3				
2530.18	2	Vd I Cr II	19 108	2530.174 2530.18	UV UV	2532.98	3w	Mg I		2532.977	38
2530.25	2					2533.13	3	Fe		2533.140	7
2530.45	2	Cr I	30	2530.44	UV	2533.20	3				
2530.54	2	Co I		2530.546	50	2533.26	1	Ge I	2	2533.230	25
2530.68	5	Fe I	8	2530.687	7	2533.32	1	Mn II	55	2533.329	19
2530.86	1					2533.45	1	Cr II Mn II	108 55	2533.45 2533.462	UV 19
2531.08	3	Fe II	33	2531.082	UV	2533.62	4w	Fe II	159	2533.626	UV
2531.24	4	Ti II	4	2531.267	56	2533.72	4	Fe IMg I		2533.737 2533.750	7 38
2531.42	3	Fe I		2531.429	7	2533.80	4	Fe I Co II	 27	2533.804 2533.823	7 18
2531.54	3	Fe I	162	2531.51	UV	2533.91	2				
2531.60	1					2533.99	3	P I	8	2533.976	55
2531.76	1	Cr I	28	2531.76	UV	2534.10	2	Mg I Mn II	 55	2534.072 2534.098	38 19
2531.83	4	Mn II ICr II	55 9	2531.799 2531.84	19 UV	2534.24	1	Mn II	55	2534.221	19
2531.98	2					2534.35	4	Cr II	9	2534.33	UV
						2534.42	4D	Fe II	159	2534.413	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2534.56	1	Vd II	38	2534.519	UV	2537.44	4	Fe I	102	2537.458	7
2534.62	4	Ti II	4	2534.629	56	2537.53	1	Mg I		2537.557	38
2534.72	2					2537.75	1h				
2534.86	1					2537.84	2				
2534.96	1W	Mg I		2534.937	38	2537.94	2h	Mn II	55	2537.919	19
2535.08	1	Mg I		2535.079	38	2538.00	2h	Mn II	55	2538.041	19
2535.12	4	Fe I	60	2535.128	7	2538.21	4	Fe II	319	2538.205	UV
2535.30	3					2538.25	1	Fe I		2538.262	43
2535.47	5	Cr I II Fe II	9 177	2535.47 2535.480	UV UV	2538.39	3	Fe II Mg I	178	2538.393 2538.426	UV 38
2535.60	6	P I Fe I	8 7	2535.603 2535.607	55 7	2538.50	4	Fe II	160	2538.500	UV
2535.67	2	Mn II	21	2535.658	19	2538.60	3	Fe II	268	2538.577	UV
2535.74	1					2538.70	3	Fe II Fe I	363 57	2538.681 2538.699	UV 7
2535.86	4	Ti II	4	2535.885	56	2538.79	} 3d	I Fe II	158	2538.794	UV
2535.96	4	Co I Mn II	3 21	2535.961 2535.977	UV 19	2538.82		Fe?		2538.829	7
2536.16	3					2538.91	5	I Fe II Cr I?	158 9	2538.898 2538.95	UV UV
2536.32	3w	Mg I		2536.303	38	2538.99	5	Fe II	158	2539.003	UV
2536.36	1H					2539.10	3	IMg I Ni II		2539.089 2539.100	38 52
2536.43	1H	Mg I		2536.465	38	2539.20	2	Vd II?	186	2539.20	UV
2536.50	3	Hg I	1	2536.517	UV	2539.35	4	Fe I	55	2539.357	7
2536.69	5	Fe II	241	2536.673	UV	2539.51	1	Cr II	9	2539.52	UV
2536.82	5D	Fe I Fe II Fe II	58 159 159	2536.792 2536.822 2536.822	7 UV UV	2539.58	2	Fe I	56	2539.587	7
2537.17	5	Fe II	363	2537.142	UV	2539.74	1	Mg I		2539.720	38
2537.36	2					2539.80	2	Fe II	176	2539.797	23
						2539.94	2				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2540.02	3	Ni I Fe II	53 267	2540.019 2540.053	UV UV	2542.95	2w	Mn II Mn II	21 21	2542.923 2542.979	19 19
2540.23	2					2543.09	1	Fe II		2543.063	10
2540.27	3					2543.13	1	Cr II	108	2543.14	UV
2540.44	2	Fe		2540.441	7	2543.38	5	Fe II	159	2543.382	UV
2540.52	1	Mg I Fe II		2540.510 2540.531	38 23	2543.43	4	Fe II Mn II	177 21	2543.431 2543.454	UV 19
2540.66	5	Co II Fe II Fe II	27 177 343	2540.626 2540.669 2540.669	18 UV UV	2543.66	3	Mg I		2543.666	38
2540.71	3	Fe Mn II		2540.730 2540.749	7 19	2543.91	6	Fe I	162	2543.923	7
2540.97	6W	Fe I	7	2540.972	7	2544.05	3	Mg I		2544.068	38
2541.09	4	Fe II Mn II	177 22	2541.096 2541.112	UV 19	2544.24	4	Co I Cr II	3 9	2544.252 2544.26	UV UV
2541.26	3					2544.43	3w	Fe I Mg I	58	2544.462 2544.464	29 38
2541.39	2h	Cr I	29	2541.359	UV	2544.64	6	Fe I	58	2544.658	7
2541.62	3h					2544.70	6	Cr I Fe I	9 162	2544.702 2544.705	UV 7
2541.83	4	Fe II	158	2541.831	UV	2544.80	1	Cu II	92	2544.805	25
2541.94	4	Ti I Co II	8 14	2541.910 2541.936	58 18	2544.85	1	Co I		2544.862	50
2542.09	5	Zr II Fe I	7 162	2542.09 2542.101	UV UV	2544.96	3	Fe II	147	2544.972	UV
2542.17	1					2545.01	1	Co II	17	2545.038	18
2542.32	2	Fe II Zn I	33 8	2542.316 2542.32	UV UV	2545.21	4w	Cr I Fe II	27 159	2545.21 2545.215	UV UV
2542.37	4W	Mg I Mg I		2542.350 2542.368	38 38	2545.44	3	Fe II	267	2545.432	UV
2542.68	1					2545.54	4	Fe II	178	2545.513	UV
2542.72	4	Fe II	223	2542.733	UV	2545.65	2	Cr I	24	2545.645	UV
2542.84	2					2545.75	1	Mg I		2545.764	38
						2545.97	6W	Fe I	7	2545.978	7
						2546.10	2	Fe		2546.104	7

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2546.16	3	Co II Fe I		2546.156 2546.174	18 7	2549.21	2				
2546.31	3w	Mg I		2546.304	38	2549.29	2	Vd II Co I	38 4	2549.272 2549.296	UV UV
2546.44	1	Cr II	108	2546.45	UV	2549.40	5	Fe II	177	2549.399	UV
2546.66	5	Fe II	177	2546.667	UV	2549.45	5	Fe II	177	2549.453	UV
2546.74	1	Co II		2546.745	18	2549.55	5	Ni I Ni II Cr I	51 48 24	2549.532 2549.548 2549.548	UV 52 UV
2546.86	5	Fe I Ti II		2546.866 2546.88	7 47						
2547.06	1					2549.61	6W	Fe I	7	2549.613	7
2547.22	2	Mg I		2547.21	38	2549.76	4	Fe II	266	2549.774	UV
2547.33	3	Fe II	158	2547.330	UV	2549.95	2	Vd I	15	2549.965	UV
2547.41	2	Ni I	52	2547.409	UV	2550.02	5	Fe II	240	2550.023	UV
2547.46	1	Fe I		2547.468	29	2550.13	4	Fe II	363	2550.155	UV
2547.65	2					2550.38	1	Cr I	25	2550.364	UV
2547.91	4	-Fe II?		2547.931	10	2550.52	3	Fe		2550.506	7
2548.08	4w	Cr II II Fe I	108 130	2548.04 2548.084	UV 7	2550.58	2	Fe II	158	2550.575	UV
2548.14	1	Fe II	176	2548.166	UV	2550.69	4	I Fe II Zr II	240 7	2550.680 2550.71	UV UV
2548.32	4	Fe II Co I	146 112	2548.325 2548.333	UV UV	2550.81	3	Fe I	55	2550.812	29
2548.38	2	Mg I		2548.407	38	2551.10	5	Fe I Mg I		2551.092 2551.122	7 38
2548.51	3	Mg I		2548.51	38	2551.19	3w	Mg I Fe II Fe II		2551.16 2551.201 2551.201	38 23 23
2548.58	2	Cr II Fe II	109 158	2548.58 2548.590	UV UV	2551.28	1				
2548.65	2	Vd II	38	2548.685	UV	2551.38	1	Mn II?		2551.35	19
2548.74	5	I Fe II Mn II	145 55	2548.741 2548.750	23 19	2551.45	2W				
2548.91	4	Fe II	319	2548.925	UV	2551.59	2	Cr II	109	2551.58	UV
2549.11	4w	Fe II-	284	2549.082	UV	2551.84	3	Mn II	32	2551.851	19

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2551.98	3					2554.93	5	IP I— Fe II	8 205	2554.915 2554.950	55 UV
2552.19	2					2555.07	5	Fe II Co I	177 56	2555.066 2555.074	UV UV
2552.37	5	Sc II	1	2552.38	UV	2555.22	4	Fe		2555.219	7
2552.55	2	Fe II		2552.544	10	2555.42	2	Cr I	26	2555.42	UV
2552.62	5	II Fe I	8	2552.606	7	2555.45	5	Fe II	177	2555.447	UV
2552.73	4	Vd I	15	2552.648	UV	2555.55	3				
2552.82	5w	Fe I Cr I I Fe I	56 27 55	2552.786 2552.79 2552.831	43 UV 7	2555.63	3	Fe I	58	2555.647	7
2552.97	4w	Vd II Co I	69 56	2552.960 2553.004	UV UV	2555.78	4				
2553.04		Vd II	69	2553.028	UV	2555.98	4	Ti II	9	2555.988	UV
2553.18	4	Mn II Fe I		2553.158 2553.193	19 UV	2556.20	3				
2553.25	5	Mg I P I Mn II	8 55	2553.256 2553.262 2553.267	38 55 19	2556.31	5	Ge I I Fe I Fe I	25 102 56	2556.298 2556.303 2556.321	25 7 43
2553.37	5	Co I INi I	56 4	2553.337 2553.373	UV UV	2556.55	4w	Mg I Mn II	20	2556.55 2556.573	38 19
2553.49	3	Fe I	58	2553.49	43	2556.76	3	Co I	55	2556.762	UV
2553.67	2	Vd II	38	2553.668	UV	2556.87	5	II Fe I Mn II	53 20	2556.863 2556.894	7 19
2553.74	4	Fe II Mg I	127	2553.738 2553.776	UV 38	2557.00	3	Fe I		2557.020	29
2553.86	2	Fe I?		2553.84	51	2557.08	2	Fe II	158	2557.079	UV
2554.05	2					2557.16	2	Cr I Cr I	24 25	2557.144 2557.144	UV UV
2554.22	4	Fe I		2554.218	29	2557.23	3	Mg I		2557.226	44
2554.42	2	Fe II	298	2554.435	UV	2557.27	4	Fe I	101	2557.270	7
2554.56	5w	Mg I		2554.565	38	2557.35	2	Co II	17	2557.332	18
2554.71	1	Fe I	130	2554.711	43	2557.45	2	Cr II	89	2557.45	UV
						2557.52	4d	Fe II Mn II	175 20	2557.500 2557.543	UV 19

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2557.60	1	Mn II	20	2557.594	19	2560.16	1	Ni II	62	2560.156	52
2557.77	3	Fe I		2557.792	29	2560.24	4	Sc II	1	2560.26	UV
2557.83	4	Mg I		2557.86	38	2560.28	5	Fe II	221	2560.278	UV
2557.97	3	Fe I		2557.982	29	2560.44	3	Fe II	158	2560.443	23
2558.11	3	Fe I		2558.118	29	2560.55	4	Mg I		2560.53	38
2558.20	1	Ca I	11	2558.174	45			Fe I	56	2560.556	7
2558.24	1	Ti I		2558.233	58	2560.70	3	Cr I	24	2560.695	UV
2558.27	1					2560.78	2	Mn II? Fe I?		2560.76 2560.777	19 43
2558.31	3H	Mn II—		2558.304	19	2560.87	1				
2558.37	2					2560.94	4w	Mg I		2560.941	44
2558.49	4w	Fe?		2558.478	7	2561.08	1	Fe I		2561.068	29
2558.60	3	Mn II	20	2558.605	19	2561.20	3				
2558.81	2	Fe I		2558.822	7	2561.27	4	Fe I	58	2561.271	7
2558.92	1	Vd I	15	2558.893	UV	2561.32	1	Cr I?	25	2561.33	UV
2559.10	5w	Fe I—		2559.080	29	2561.42	4	Ni I	3	2561.424	UV
2559.23	4	Fe II	266	2559.237	UV	2561.57	3w	Fe II	205	2561.584	UV
2559.33	4					2561.69	4	Fe		2561.700	7
2559.40	5	Co II Mn II	15 20	2559.407 2559.413	18 19	2561.85	5	Fe I	55	2561.855	7
2559.46	3					2562.11	5w	Fe II— Co I Vd I	221 3 15	2562.094 2562.124 2562.125	UV UV UV
2559.56	1					2562.23	5w	Fe I Fe I Mg I	55 55	2562.222 2562.225 2562.259	7 7 44
2559.66	3	Ni I Mn II	20	2559.655 2559.679	UV 19	2562.54	7W	Fe II	64	2562.535	UV
2559.77	4w	Mn II IFe II	20 205	2559.741 2559.774	19 UV	2562.69	1				
2559.91	5w	Fe II	267	2559.921	UV	2562.89	1				
2560.03	2	Co II		2560.026	18	2563.08	2				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2563.18	3					2565.85	3	Fe I		2565.870	43
2563.23	2	Sc II	1	2563.23	UV	2565.95	2	Ni II Fe II	62	2565.923 2565.959	52 10
2563.41	5w	Fe I	54	2563.399	7	2565.98	1	Cr I Cr I	26 83	2566.00 2566.00	UV UV
2563.49	6W	Fe II	64	2563.472	UV	2566.02	2	Mn II	20	2566.035	19
2563.65	5w	Mn II Si I	20 44	2563.642 2563.679	19 37	2566.21	4	Fe II	404	2566.218	23
2563.84	3	Fe I Fe II	55 266	2563.809 2563.834	7 UV	2566.40	3	Fe II	405	2566.397	23
2563.88	2					2566.50	4	Mg I		2566.51	38
2563.99	2	Fe I		2563.990	29	2566.62	5	Fe II	174	2566.623	UV
2564.03	4	Co II	15	2564.036	18	2566.91	6W	Fe II	64	2566.908	UV
2564.17	3	Ti II		2564.179	56	2567.35	5w	Fe II? Co I	419 3	2567.326 2567.344	UV UV
2564.36	2w					2567.63	3	Zr II Fe II	7	2567.62 2567.637	UV 7
2564.56	4w	Fe I	58	2564.560	7	2567.80	5	Zn I	8	2567.80	UV
2564.82	4	Vd I Si I	15 44	2564.817 2564.824	UV 37	2567.88	5	Fe I	130	2567.859	7
2564.94	5	Mg I		2564.937	44	2567.97	7	Al I	2	2567.983	14
2565.02	4					2568.10	2h	Cr I	22	2568.098	UV
2565.12	1	Ca I	11	2565.124	45	2568.17	3				
2565.21	3	Mg I Mn II	20	2565.19 2565.219	38 19	2568.27	2				
2565.26	3					2568.33	3				
2565.30	2	Fe II	419	2565.306	UV	2568.41	5	Fe II	145	2568.405	UV
2565.36	3	Co II	17	2565.371	18	2568.53	1	Mn II? Cr I	67 25	2568.515 2568.52	19 UV
2565.46	3	Fe I?		2565.45	51	2568.64	6w	Si I	85	2568.641	37
2565.52	1					2568.86	6	Zr II Fe I Fe II	7 54 175	2568.85 2568.865 2568.879	UV 7 UV
2565.58	2										
2565.74	4										

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2568.96	2	Ti II		2568.977	56	2571.54	4	Fe II Fe I	174 103	2571.542	UV
2569.02	2									2571.57	UV
2569.08	2					2571.68	3	Hf II	11	2571.678	5
2569.19	3	Mg I		2569.20	38	2571.75	5	Cr I Cr II	24 89	2571.74 2571.78	UV UV
2569.29	3					2571.87	1	Mn II?	67	2571.892	19
2569.34	5	Fe I— Fe II		2569.322 2569.365	29 10	2572.05	3	Fe I?— Cr I		2572.020 2572.07	43 UV
2569.46	2	Sr I	4	2569.469	UV	2572.15	3	Cr I	22	2572.15	UV
2569.58	5w	Fe I	52	2569.596	7	2572.24	5W	Co I II Mg I		2572.234 2572.248	50 44
2569.76	6d	Fe I Fe II Fe II	55 266 349	2569.744 2569.775 2569.775	7 23 23	2572.36	1				
2569.93	4					2572.42	2				
2570.24	1					2572.54	3				
2570.34	2					2572.63	4	Ti II		2572.648	UV
2570.48	5					2572.75	5	Fe I Mn I	102 12	2572.753 2572.755	7 UV
2570.52	6	Fe II	412	2570.527	23	2572.85	2				
2570.68	1h					2572.95	4	Fe II	190	2572.965	23
2570.84	5	Fe II	284	2570.843	UV	2573.12	1				
2570.89	5	Mg I		2570.908	44	2573.20	4w	Fe II	205	2573.206	UV
2570.93	4					2573.39	2	Co I		2573.395	50
2571.07	5	Ti II	9	2571.036	UV	2573.53	3	Co I Cr II		2573.538 2573.54	50 UV
2571.19	1	Fe II Ti II		2571.176 2571.18	23 38	2573.62	2				
2571.27	2					2573.74	4d	Ti II— Fe II	9 284	2573.72 2573.754	UV UV
2571.38	3					2573.92	2	Ti II— Fe II?		2573.91 2573.948	47 10
2571.45	3	Zr II Zr II	7 7	2571.42 2571.42	UV UV	2574.02	2	Vd I	15	2574.020	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2574.18	3w					2577.66	4	ICr I Vd II	24 68	2577.66 2577.682	UV UV
2574.36	6W	Co I Fe II	3 144	2574.351 2574.363	UV UV	2577.91	7W	Mg I IFe II	64	2577.888 2577.920	44 UV
2574.52	2w	Vd II	38	2574.520	UV		5W	Fe		2578.003	7
2574.59	2					2578.14	2				
2574.66	1	Cr I	67	2574.68	UV	2578.29	3d	Cr I Cr II	67 89	2578.27 2578.31	UV UV
2574.78	2w					2578.46	4	Ni I	28	2578.465	UV
2574.87	5	Co II	17	2574.867	18	2578.54	1				
2574.93	6	Mg I		2574.945	44	2578.65	3				
2575.08	7	Al I	2	2575.095	14	2578.81	5w	Fe I		2578.825	UV
2575.32	4					2578.91	1	Co I	113	2578.924	50
2575.39	6	Al I	2	2575.397	14	2578.98	2	Fe II	265	2578.985	UV
2575.50	5	Mn I	12	2575.509	UV	2579.12	4	Fe II Cr I	22	2579.127 2579.14	23 UV
2575.60	3					2579.18	5	Fe I		2579.183	43
2575.73	5	Co I IFe I	4	2575.733 2575.742	50 7	2579.26	6	Fe I Fe I	55 53	2579.260 2579.266	7 UV
2576.12	8W	Mn II	1	2576.105‡	19	2579.42	4d	Fe II Fe II	239 266	2579.406 2579.406	UV UV
2576.43	3										
2576.53	4	Mg I		2576.545	38	2579.50	2	Fe I		2579.504	43
2576.68	6	Fe I	52	2576.691	7	2579.59	3				
2576.86	5	Fe II	326	2576.859	UV	2579.67	1				
2576.96	5	Fe I		2576.979	43	2579.84	4	Fe I		2579.844	7
2577.16	5	Si I	84	2577.151	37	2580.05	5d	Cr I Cr I IFe I	26 26 54	2580.04 2580.04 2580.065	UV UV 7
2577.22	2					2580.32	5w	Co II	14	2580.323	18
2577.32	4	Vd I—	15	2577.292	UV	2580.45	4	Fe I	54	2580.453	7
2577.43	4	Fe II	175	2577.431	UV						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2580.57	5	Mg I		2580.587	44	2583.85	1				
2580.67	2h					2584.00	3	Ni II	48	2583.998	52
2580.82	4	Co I		2580.838	50	2584.09	3	Cr II Mn I	89 12	2584.10 2584.100	UV UV
2580.96	2	Fe I	55	2580.939	29	2584.21	4	Mg I		2584.216	44
2581.12	3	Fe II	190	2581.111	23	2584.28	6	Mn I Mn I	12 12	2584.302 2584.302	UV UV
2581.22	1	Co II		2581.217	18	2584.53	6w	Fe I	52	2584.536	7
2581.47	2	Fe		2581.464	7	2584.64	3	Cr I	23	2584.67	UV
2581.56	1					2585.26	4				
2581.73	4	Ti II— Fe I?		2581.707 2581.754	56 29	2585.33	3	Co I	113	2585.335	UV
2581.83	1					2585.55	5	Mg I		2585.558	44
2582.13	3w	Cr II—	231	2582.10	UV	2585.61	4	Fe II	326	2585.629	UV
2582.26	6D	Co II Fe I	14	2582.220 2582.297	18 UV	2585.90	9W	Fe I Fe II		2585.875 2585.876	51 UV
2582.40	4	Fe II	310	2582.422	UV	2586.46	3				
2582.58	6W	Fe II	64	2582.582	UV	2586.56	3	Fe I	171	2586.557	UV
2582.80	4					2587.22	5	Co II	14	2587.221	18
2582.90	2	C I	60	2582.901	37	2587.26	3	Ni II	17	2587.289	52
2582.99	2	Vd II Cr I	68 67	2583.007 2583.02	UV UV	2587.34	2				
2583.05	5	Fe II	174	2583.047	UV	2587.60	2	Mn II	32	2587.598	19
2583.16	2	Co II		2583.178	18	2587.86	1				
2583.25	2	Ti I	7	2583.221	58	2587.98	6D	Fe II Fe I	326	2587.945 2588.010	UV UV
2583.36	3	Fe II	266	2583.343	UV	2588.19	4	Fe II Cr I	145 22	2588.182 2588.19	23 UV
2583.50	1					2588.27	5	Mg I		2588.285	44
2583.64	2d	Cr II	89	2583.61	UV	2588.47	2				
2583.78	2	Fe I		2583.754	51						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2588.61	2					2592.78	5	Fe II	318	2592.781	23
2588.79	4	Fe II	265	2588.786	UV	2592.94	5	Mn I	12	2592.944	UV
2588.88	3	Fe I		2588.898	29	2593.08	3w				
2588.95	2	Mn II		2588.972	19	2593.24	5	Mg I Fe I	171	2593.231 2593.268	44 29
2589.05	2	Cr II	301	2589.05	UV	2593.52	5	Fe I	146	2593.510	UV
2589.18	2h	Ge I	2	2589.188	25	2593.72	7W	Fe II Mn II	64 1	2593.722 2593.724	UV 19
2589.32	1	Fe II		2589.326	10						
2589.70	4w	Cr II Mn II	124 54	2589.70 2589.727	UV 19	2594.03	5	Fe I		2594.046	UV
2589.79	1					2594.14	5w	Fe I Co I	52 3	2594.141 2594.161	7 UV
2589.97	2										
2590.13	3	Mn II		2590.150	19	2594.27	2				
2590.25	3	Ti I	7	2590.247	58	2594.43	4				
2590.31	4					2594.47	3	Fe II		2594.483	38
2590.43	1					2594.70	3h	Fe II Mn II	36	2594.671 2594.733	10 19
2590.55	5	Fe II	145	2590.548	UV	2594.86	1				
2590.59	1	Co I	110	2590.594	UV	2594.96	3	Fe II	310	2594.964	UV
2590.71	4	Cr II	70	2590.72	UV	2595.20	1				
2590.86	3w	Fe I		2590.870	43	2595.28	4	Fe II Fe II	203 172	2595.278 2595.285	38 UV
2590.93	4					2595.41	3	Fe I	54	2595.425	7
2591.12	3					2595.53	2	Cr II	262	2595.55	UV
2591.26	5	Fe I		2591.252	UV	2595.62	1w				
2591.55	6W	Fe II	64	2591.542	UV	2595.78	5w	Mn I	12	2595.763	UV
2591.71	3	Co I	55	2591.686	UV	2595.96	4	Mg I		2595.973	44
2591.85	5	Cr I	24	2591.84	UV	2596.07	3	Fe I	171	2596.077	29
2592.27	4w	Fe I		2592.285	29	2596.15	2W	Cr II	217	2596.17	UV
2592.53	4	Ge I	1	2592.534	25						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2596.43	5					2602.58	2				
2596.52	2					2602.72	3w	Mn II		2602.725	19
2596.60	4	Ti I— Fe I	6 51	2596.564 2596.618	58 29	2603.03	3	Mn II Fe I	54	2603.035 2603.042	19 29
2596.73	1w	Mn II	36	2596.745	19	2603.15	2				
2597.14	4					2603.41	3				
2597.44	4	Fe I		2597.443	29	2603.46	2				
2597.83	2					2603.56	5	Fe I Cr I	22	2603.554 2603.56	7 UV
2597.91	1	Fe II	342	2597.943	UV	2603.60	1				
2598.37	9W	Fe II	1	2598.369	UV	2603.73	3w	Mn II	36	2603.720	19
2599.14	4W					2603.86	6	Mg I		2603.854	44
2599.40	9W	Fe II	1	2599.395	UV	2604.01	5				
2599.57	5W	Fe I	52	2599.565	UV	2604.10	3	Ti II		2604.099	56
2600.20	2	Fe II— Fe I	203	2600.170 2600.202	38 UV	2604.17	1	Cr II	105	2604.16	UV
2600.31	1	Mn II	54	2600.283	19	2604.39	2	Co II		2604.401	18
2600.40	1W	Fe II	204	2600.415	UV	2604.51	1				
2600.60	1	Cr I	21	2600.61	UV	2604.66	4	Fe II	265	2604.655	UV
2600.78	1	Ni II?		2600.78	52	2604.74	5	Fe I		2604.754	7
2600.98	3	Co I	53	2600.977	UV	2604.86	4	Fe I Ti I	7	2604.864 2604.883	7 58
2601.05	1	Ni II	62	2601.029	52	2604.95	3				
2601.50	3	Mn II	54	2601.520	19	2605.03	3	Fe II	404	2605.034	23
2601.58	2					2605.13	4	Ti I	6	2605.121	58
2601.88	2	Cr II Cr I?	124 21	2601.85 2601.88	UV UV	2605.30	4	II Fe II Ni II	342 62	2605.307 2605.331	UV 52
2602.35	2	Mn II?		2602.35	19	2605.42	5	Fe II	204	2605.416	UV
2602.49	5w	II Mg I Cr I		2602.495 2602.50	44 UV						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2605.67	6W	Fe I IMn II	51 1	2605.657 2605.682	7 19	2609.94	1	Ni II	62	2609.945	52
2605.90	4	Fe II	356	2605.895	23	2610.00	1	Fe		2610.006	7
2606.12	4w	Co I	55	2606.120	UV	2610.08	1				
2606.29	5d	-Fe		2606.303	7	2610.20	6	Mn II	19	2610.200	19
2606.51	5	IFe II Cr II Cr II	342 63 243	2606.514 2606.53 2606.53	UV UV UV	2610.30	1	Fe II?		2610.326	10
2606.61	5	Mg I		2606.621	44	2610.44	4	Fe		2610.442	7
2606.82	6	Fe I	52	2606.827	7	2610.59	3w	Vd II?		2610.61	UV
2607.09	9W	Fe II	1	2607.086	UV	2610.75	5w	Fe I Co I	6 53	2610.750 2610.762	7 UV
2607.74	3	Vd I?		2607.752	UV	2610.93	2				
2607.81	4	Fe I	146	2607.823	43	2611.08	6d	Cr II? IFe II	124 64	2611.04 2611.075	UV UV
2607.91	3	Cr II	70	2607.90	UV	2611.29	4	Ti I	6	2611.288	58
2608.12	3					2611.35	4	Fe II	173	2611.339	UV
2608.20	4	Cr II-	105	2608.17	UV	2611.89	9W	Fe II	1	2611.873	UV
2608.30	1	Fe I		2608.292	43	2612.38	2	Ni I	4	2612.400	38
2608.43	2d	Fe II Ti II		2608.400 2608.45	23 38	2612.64	3	Fe II		2612.641	38
2608.58	5	Fe I		2608.577	7	2612.77	6	Fe I	6	2612.772	7
2608.77	1w					2613.27	3	Fe I Cr I		2613.265 2613.305	7 UV
2608.84	5	Fe II	171	2608.852	UV	2613.36	2	Mg I	14	2613.357	44
2609.05	3	Fe?		2609.036	7	2613.50	3	Co II- Cr II	17 269	2613.494 2613.51	18 UV
2609.12	4	Fe II	310	2609.122	UV	2613.58	3	Fe II	172	2613.576	UV
2609.20	4	Fe I		2609.221	7	2613.85	8W	Fe II	1	2613.820	UV
2609.43	4	Fe II	265	2609.431	UV	2614.12	3	Co I	3	2614.124	UV
2609.58	5	Fe		2609.579	7	2614.18	4	Fe II	264	2614.177	UV
2609.86	4w	Fe II	204	2609.859	UV						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2614.33	4					2618.36	4	Cu I	18	2618.366	UV
2614.36	5	Co II	20	2614.359	18	2618.53	3				
2614.49	6	Fe I	52	2614.494	7	2618.57	3				
2614.58	3	Fe II	203	2614.561	10	2618.71	7	Fe I	6	2618.710	7
2614.72	5	Mg I	14	2614.726	44	2618.85	5	Fe I		2618.850	29
2614.87	5	Fe II	171	2614.867	UV	2618.91	3	Mn I	27	2618.911	UV
2614.94	3w					2619.03	5				
2615.04	1	Ni II	65	2615.056	52	2619.07	5	Fe II	171	2619.071	UV
2615.21	4					2619.15	3				
2615.42	5	ILu II Fe I		2615.42 ± 2615.422	35 7	2619.27	3	Co I	55	2619.276	50
2615.51	2					2619.35	1				
2615.80	3					2619.50	4W	Cr I IMn I	58 26	2619.504 2619.510	UV 4
2615.85	4	Fe I		2615.849	7	2619.68	3				
2615.99	5					2619.80	2	Ti I	5	2619.800	58
2616.15	2h	Cr II?		2616.18	UV	2619.95	4w	Ti I— Mn I	6 27	2619.940 2619.980	58 4
2616.26	3	Vd II Co I	90 112	2616.24 2616.260	UV UV	2620.16	6	Fe II	173	2620.175	UV
2616.40	4d					2620.41	7W	Fe II	1	2620.408	UV
2616.50	3	Mn II	19	2616.521	19	2620.69	6	Fe II	171	2620.693	UV
2616.86	3					2620.80	3	Ni I	3	2620.825	38
2617.13	5	Fe		2617.132	7	2620.89	1w	Fe II	203	2620.899	38
2617.36	4w					2621.06	1	Fe II?		2621.076	10
2617.63	8W	Fe II	1	2617.618	UV	2621.19	2				
2618.02	7	Fe I	52	2618.018	7	2621.41	2				
2618.13	6	Mn II	19	2618.145	19	2621.46	3	Fe I		2621.472	43
2618.26	3w	Cr I	20	2618.273	UV	2621.68	8W	Fe II	1	2621.669	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2621.95	5	Fe I?		2621.965	7	2625.92	4	Fe II	203	2625.889	38
2622.05	4	Co I	54	2622.059	UV	2626.00	2				
2622.25	3	Co I	54	2622.250	UV	2626.16	2				
2622.29	2					2626.42	3	Ni II	62	2626.426	52
2622.42	3	Co I	54	2622.430	UV	2626.50	6	Fe II	173	2626.499	UV
2622.65	1					2626.60	3	Cr I	21	2626.601	UV
2622.74	1	Hf II	8	2622.739	5	2626.64	3	Mn I	26	2626.635	4
2622.87	5	Cr I	21	2622.867	UV	2626.68	4	Fe II	203	2626.695	UV
2622.90	3	Mn I	27	2622.895	UV	2626.86	3				
2623.00	3					2627.03	3 _w				
2623.13	3	Fe II	318	2623.129	UV	2627.14	5	Fe I		2627.127	7
2623.29	1	Mn I?	24	2623.284	4	2627.22	4	Fe I	51	2627.224	7
2623.37	6	II Fe I Cr II	6 124	2623.366 2623.39	7 UV	2627.46	2				
2623.54	7	Fe I	52	2623.533	7	2627.63	3 _h	Co I	54	2627.638	UV
2623.63	4	Fe		2623.626	7	2628.30	8 _W	Fe II	1	2628.291	UV
2623.73	5	Fe II Co I	171	2623.721 2623.755	UV 50	2628.55	2 _w	Fe II	203	2628.569	UV
2624.04	3	Mn I	27	2624.043	UV	2628.66	4	Mg I	13	2628.664	44
2624.13	4					2628.99	2 _w	Fe I		2629.000	43
2624.43	1	Fe II?		2624.455	10	2629.18	3	Fe I?		2629.19	51
2624.50	1					2629.38	1 _w				
2624.66	3	Fe		2624.661	7	2629.58	7	Fe I Fe II	6 171	2629.572 2629.590	7 UV
2624.77	4 _w	Mn II	19	2624.761	19	2629.72	3	Fe		2629.721	7
2625.32	4	Cr I	20	2625.318	UV	2629.82	4	Cr I	20	2629.815	UV
2625.50	6	Fe II	318	2625.489	23	2630.07	7 _W	Mg I I Fe II	13 171	2630.053 2630.068	44 UV
2625.68	8 _W	Fe II	1	2625.664	UV	2630.29	2				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2630.59	2	Mn I	24	2630.565	4	2635.00	1	Fe II		2634.993	23
2630.69	5	Vd II	150	2630.665	UV	2635.31	5	Fe II?—		2635.314	10
2630.81	3					2635.40	4	Fe II Fe II	238 296	2635.401 2635.401	UV UV
2631.04	8W	Fe II Fe II	1 171	2631.045 2631.045	UV UV	2635.56	1				
2631.33	8W	Fe II	1	2631.321	UV	2635.65	3				
2631.61	7	Fe II	171	2631.607	UV	2635.71	4	Fe		2635.723	7
2632.02	2	Mn II	19	2632.006	19	2635.81	7	Fe I	52	2635.809	7
2632.11	2					2635.93	3	Fe		2635.932	7
2632.24	6	Fe I Co II	52 20	2632.237 2632.260	7 18	2636.10	3w	Co II Fe Cr I?		2636.072 2636.075 2636.094	18 7 UV
2632.36	5	Mn II	19	2632.354	19	2636.49	6	Cr II IFe I	62 51	2636.46 2636.478	UV 7
2632.42	4	Ti I	5	2632.414	58	2636.70	4	Fe II	356	2636.687	23
2632.60	6	Fe I	6	2632.594	7	2636.79	5				
2632.87	5w	Mg I	13	2632.873	44	2636.96	4				
2632.99	5	Fe?		2632.988	7	2637.05	5	Fe?		2637.054	7
2633.05	4	Fe II	203	2633.070	38	2637.20	3d	Cr I?— Cr II	19 62	2637.168 2637.20	UV UV
2633.20	4	Fe II	356	2633.200	23	2637.34	1				
2633.32	1					2637.48	3	Cr II Fe II	198 410	2637.48 2637.515	UV UV
2633.42	4	Fe II?		2633.410	38	2637.64	5	Fe II	221	2637.643	UV
2633.54	3	Ni II?	45	2633.558	52	2637.68	1	Al II	14	2637.689	26
2633.62	4	Fe I?		2633.621	7	2637.89	3				
2634.03	3h					2638.15	6	Mn II	19	2638.173	19
2634.35	4					2638.36	1				
2634.74	5	Fe?		2634.740	7	2638.46	1				
2634.93	2h	Fe I? Co II		2634.917 2634.923	43 18						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2638.58	2	Fe Mn II		2638.560 2638.567	7 19	2641.64	6	Fe I	50	2641.646	7
2638.73	3d	Ti II? Fe	29	2638.70 2638.747	UV 7	2641.74	3W				
2638.91	2	Cr I		2638.892	28	2642.01	4	Fe II	309	2642.015	UV
2639.04	3					2642.12	3	Cr I	66	2642.118	UV
2639.08	3	Zr II	4	2639.07	UV	2642.21	3	Vd II	89	2642.212	UV
2639.16	4					2642.27	4	Fe I	51	2642.274	29
2639.37	3	Ni II?		2639.358	52	2642.38	1	Fe II		2642.382	23
2639.42	3					2642.61	1w				
2639.57	5	Fe II	221	2639.560	UV	2642.77	1				
2639.86	5	Mn II	52	2639.849	19	2642.87	1w	Co I		2642.884	50
2639.93	2					2642.96	2	Fe II	426	2642.982	23
2640.04	2	Cr I	20	2640.056	UV	2643.17	2d	Ni I—	72	2643.146	UV
2640.20	4	Fe I?		2640.23	51	2643.28	1				
2640.31	3					2643.39	2	Zr II		2643.40	UV
2640.48	2W					2643.52	3	Cr II	123	2643.54	UV
2640.62	1					2643.75	2h	Fe II		2643.763	23
2640.71	1					2643.99	7	Fe I	52	2643.998	7
2640.79	1h					2644.26	5	Ti I	5	2644.253	58
2641.03	4	Fe I		2641.029	7	2644.34	3				
2641.11	2	!Ti I Fe II	5 144	2641.089 2641.124	58 UV	2644.52	1				
2641.17	2					2644.60	2	Fe		2644.628	7
2641.30	1w					2644.80	4w	Mg I	12	2644.801	44
2641.42	3	Hf II	7	2641.410†	5	2645.03	2				
2641.50	4	Au I—	4	2641.49	UV	2645.08	4	Fe II Fe II	263 309	2645.084 2645.084	UV UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2645.19	2	Fe II	421	2645.191	23	2648.54	4	Fe I		2648.548	29
2645.33	2	Fe II	426	2645.328	23	2648.64	4	Co I	53	2648.635	UV
2645.42	5	Fe I	6	2645.422	7			Co I	53	2648.635	UV
2645.64	2	Fe II		2645.637	10			Ti I	4	2648.644	58
2645.84	4	Vd II	89	2645.840	UV	2648.72	6	Fe II	409	2648.704	UV
2645.97	2					2648.75	2				
2646.05	2	Fe Ti II	29	2646.032 2646.088	7 56	2648.94	3	Mn II	53	2648.938	19
2646.14	2					2649.06	6	Mg I	12	2649.062	44
2646.21	5w	Fe II Mg I	237 12	2646.206 2646.206	UV 44	2649.23	4				
2646.32	3	Fe I?		2646.320	43	2649.29	3	Ti I		2649.291	58
2646.41	4	Co I	53	2646.413	UV	2649.46	3	Fe II	427	2649.467	23
2646.51	2	Fe I?		2646.50	51	2649.63	4				
2646.65	5w	Ti I	5	2646.631	58	2649.75	2				
2646.85	1	Pt I	1	2646.87	UV	2649.82	3				
2646.91	1					2649.93	3w	Co I	112	2649.931	UV
2647.25	4					2650.21	3				
2647.39	3	Fe I		2647.390	29	2650.26	4	Co I	53	2650.266	UV
2647.56	6	Fe I	6	2647.558	7	2650.38	1	Zr II	6	2650.37	UV
2647.71	1	Vd I	13	2647.710	UV	2650.47	4	Be I— Fe II	2 410	2650.454 2650.492	22 UV
2647.85	1w					2650.62	3w	Be I Be I	2 2	2650.613 2650.619	22 22
2648.08	3	Cr II	142	2648.08	UV	2650.68	4	Be I	2	2650.694	22
2648.17	5	Fe I	99	2648.164	29	2650.78	2	Be I	2	2650.760	22
2648.27	3w					2650.86	1	Pt I	6	2650.84	UV
2648.45	4					2651.04	3	Mn II	52	2651.036	19
						2651.10	2				
						2651.18	5	Ge I	1	2651.172†	25

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2651.28	3w	Fe II	237	2651.297	UV	2655.14	3	Fe I	100	2655.14	UV
2651.56	3	Ge I	1	2651.568	25	2655.35	1				
2651.70	5	Fe II Fe I	355 51	2651.691 2651.706	UV 7	2655.52	3				
2651.83	3	Fe II	427	2651.826	23	2655.65	3W				
2651.88	2	Vd I	13	2651.896	UV	2655.78	3	Cr II	103	2655.78	UV
2652.00	3	Cr II?		2652.00	UV	2655.91	4	Mn II	52	2655.924	19
2652.10	4					2656.09	3				
2652.16	4					2656.14	5	Fe I	156	2656.147	7
2652.49	6	Al I	1	2652.475	14	2656.32	4	Fe I		2656.337	29
2652.56	5	Fe II	237	2652.557	UV	2656.39	4	Ti I?		2656.359	58
2652.85	2					2656.80	5	Fe I	99	2656.792	UV
2652.93	2	Ti I	4	2652.975	58	2656.93	2	Ti I?		2656.903	58
2653.05	3					2657.19	2	Ti I	3	2657.178	58
2653.14	2	Fe I	156	2653.134	43	2657.44	4				
2653.26	4					2657.51	3h	Fe I		2657.489	43
2653.35	1					2657.91	4	Fe II	283	2657.917	UV
2653.58	5	Cr II	8	2653.57	UV	2658.10	4d	-Fe I		2658.111	29
2653.72	4	Co II	20	2653.719	18	2658.26	4	Fe II	309	2658.251	UV
2654.06	2w					2658.49	5	Fe		2658.478	7
2654.27	4	Fe I?		2654.28	51	2658.59	6	Cr II	8	2658.59	UV
2654.43	3	Cr I		2654.412	28	2658.68	4	Fe I		2658.699	29
2654.62	2	Fe II	410	2654.639	UV	2658.93	5w	Cr II-	141	2658.91	UV
2654.71	2					2659.06	2	Fe II	237	2659.054	UV
2654.79	1					2659.25	3	Fe I		2659.249	7
2654.93	1	Ti I	4	2654.921	58	2659.35	1				
						2659.39	1				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2659.45	2w	IPt I Cr II Cr II	1 103 164	2659.44 ‡ 2659.47 2659.47	UV UV UV	2662.70	3	-Cr II?	165	2662.72	UV
						2662.93	1h	Fe?		2662.901	7
2659.60	1w					2663.01	3	Cr II	165	2663.02	UV
2659.69	3h					2663.17	4	Fe I		2663.165	7
2659.83	3					2663.42	6	Cr II	8	2663.42	UV
2659.99	1h	Cr I	58	2660.006	UV	2663.53	6	Co II	13	2663.528	18
2660.11	3					2663.64	4				
2660.39	7w	Al I Fe I	1 51	2660.386 2660.397	14 7	2663.68	5	Cr II	8	2663.67	UV
2660.47	3					2663.78	5	Fe?		2663.779	7
2660.58	3					2663.92	4	Fe II	428	2663.945	7
2660.76	3w	Mg II Mg II	4 4	2660.755 2660.817	44 44	2664.05	5w	Fe I		2664.043	7
						2664.18	6d	Fe I Fe II		2664.168 2664.209	7 UV
2660.90	3h					2664.47	1h	Cr I	8	2664.44	UV
2661.20	5	Fe I	50	2661.191	7	2664.66	7w	Fe II	263	2664.665	UV
2661.30	5d	Mg II Fe I		2661.292 2661.305	38 7	2664.78	2	Ir I	1	2664.786	UV
2661.42	4	Cr II? Fe?— Vd I		2661.41 2661.416 2661.424	UV 7 UV	2665.05	3	Ga I	3	2665.05	UV
			13			2665.18	1	Mn II	62	2665.179	19
2661.52	2					2665.28	4	Ni II	45	2665.252	52
2661.61	2	Cr II	62	2661.59	UV	2665.35	3				
2661.67	5					2665.56	3	Fe II	428	2665.563	UV
2661.74	6d	ICr II Fe II	8 429	2661.73 2661.771	UV 7	2665.83	4	Ni II	45	2665.852	52
2661.96	3	Ti I	2	2661.962	58	2666.01	7W	Cr II	8	2666.02	UV
2662.06	5	Fe I	50	2662.056	7	2666.39	5	Fe I	50	2666.399	7
2662.31	5	Fe I		2662.304	7	2666.44	5				
2662.58	5	Fe II—	410	2662.563	UV	2666.64	5	Fe II	263	2666.631	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2666.77	4	Fe Mn II		2666.751 2666.769	7 19	2669.94	2 _w	Fe II	416	2669.932	23
2666.81	5 _w	Fe I	48	2666.812	7	2670.08	4 _w	Cr II	63	2670.06	UV
2666.96	5	Fe I	100	2666.965	7	2670.22	3	Cr II	69	2670.24	UV
2667.03	5	Mn II Mn II	52 70	2667.030 2667.030	19 19	2670.32	2	Ni II	45	2670.326	52
2667.22	3	Fe II	410	2667.221	UV	2670.38	2	Fe II	355	2670.384	UV
2667.37	2D					2670.52	1 _w	Zn I	6	2670.530	UV
2667.56	1 _h					2670.70	1				
2667.78	2	Zr II	5	2667.77	UV	2670.78	4	Fe I		2670.786	7
2667.91	5	Fe I	6	2667.912	7	2670.96	1	Zr II	20	2670.94	UV
2668.14	5	Mg I	11	2668.124	44	2671.00	2	Fe		2670.992	7
2668.25	1	Fe II?		2668.235	10	2671.37	2	Fe II	410	2671.404	UV
2668.34	1	Ti I	4	2668.319	58	2671.57	2				
2668.52	1					2671.81	6	Cr II	8	2671.80	UV
2668.59	1					2672.00	5	Cr I Vd II	18 3	2671.980 2672.005	UV UV
2668.72	5 _w	Cr II	8	2668.71	UV	2672.10	3				
2668.91	4	Fe I— Fe II	429	2668.910 2668.938	7 UV	2672.23	3	Fe I?		2672.20	51
2669.01	3	Fe II	429	2669.023	UV	2672.31	3	Fe II	202	2672.310	UV
2669.16	5	Al II	1	2669.157	26	2672.37	3	Cr II	122	2672.37	UV
2669.36	3	Cr I	18	2669.359	UV	2672.47	6	Mg I	11	2672.460	44
2669.41	4					2672.58	4	Mn II	34	2672.581	19
2669.49	5	Fe I	156	2669.493	7	2672.83	6 _w	Cr II	8	2672.83	UV
2669.55	5	Mg I	11	2669.553	44	2673.10	4	Fe?		2673.086	7
2669.60	5	Ti I	2	2669.592	58	2673.21	5	Fe I	50	2673.213	7
2669.78	3 _h					2673.38	3	Mn II	52	2673.379	19
						2673.49	2				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2673.55	3	Fe I		2673.552	29	2677.71	2				
2673.70	3d					2677.80	5	Vd II	3	2677.804	UV
2673.76	1					2677.85	2	Mn II	52	2677.851	19
2673.96	1	Vd II	14	2673.955	UV	2678.02	5	Ni I	69	2678.026	UV
2674.09	1	Ti I	2	2674.089	58	2678.15	4	Cr I	18	2678.15	UV
2674.18	4	Fe I?—		2674.18	51	2678.21	3				
2674.44	2	Mn II	63	2674.440	19	2678.26	4	Fe II?		2678.247	10
2674.62	3	Fe I		2674.625	29	2678.35	1	Ti I		2678.341	58
2674.72	3	Fe I	140	2674.715	7	2678.40	1				
2674.99	4	Mn II	52	2674.985	19	2678.57	5	Vd II Zr II	3 4	2678.572 2678.59	UV UV
2675.15	1	Fe II?		2675.133	10	2678.65	4				
2675.28	5	I Fe I P I	7	2675.276 2675.301	51 55	2678.79	7	Cr II	7	2678.79	UV
2675.51	2	Fe II?		2675.477	23	2679.06	7w	Fe I	47	2679.062	7
2675.67	3	Cr II	69	2675.67	UV	2679.16	2	Mn II	52	2679.166	19
2675.78	2					2679.21	4				
2675.98	4	Au I I Co I	1 53	2675.95 2675.980	UV UV	2679.32	5	Vd II	3	2679.327	UV
2676.08	5	Ti I Fe I?	4	2676.072 2676.078	58 7	2679.49	3	Fe I		2679.513	29
2676.16	3	Fe I		2676.159	7	2679.62	1	Fe II		2679.624	10
2676.30	1w	Mn I?	15	2676.326	4	2679.74	4w	Fe I Fe II		2679.714 2679.775	7 7
2676.53	3h					2679.92	3	Cr II I Ti I	267 2	2679.89 2679.923	UV 58
2676.65	1	Fe I?		2676.62	51	2680.13	5	Fe		2680.117	7
2676.90	4	Fe II	426	2676.881	23	2680.28	4	Fe II?	408	2680.244	UV
2677.16	7D	I Cr II Pt I II Cr II	8 1 8	2677.13 2677.13 2677.19	UV UV UV	2680.33	4	Cr I Mn II	18 63	2680.33 2680.338	UV 19
						2680.46	5	Fe I	50	2680.453	7

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2680.67	3d	Mn II Fe II	429	2680.681 2680.702	19 7	2684.56	5w	Mn II—	63	2684.539	19
2680.79	3	Fe II	202	2680.784	UV	2684.75	6	Fe II	283	2684.752	UV
2680.91	3	Fe I	100	2680.913	7	2684.85	5	Fe I	50	2684.857	UV
2681.05	1	Fe II Fe II	416 429	2681.038 2681.038	23 23	2684.95	5	Fe II	201	2684.940	UV
2681.25	2	Mn II		2681.252	19	2685.03	5	—Cr II	122	2685.04	UV
2681.34	2					2685.15	5w	Ti I Fe I	2	2685.137 2685.140	58 7
2681.46	4	Cr I	8	2681.46	UV	2685.22	1	Cr II Cr II	85 85	2685.19 2685.19	UV UV
2681.58	5	Fe I	145	2681.586	UV	2685.33	4	Co I	53	2685.336	UV
2681.71	1w	Mn I		2681.723	UV	2685.49	2w				
2681.88	2	Fe?		2681.885	7	2685.68	4	Vd II	3	2685.689	UV
2682.03	1	Cr I	18	2682.01	UV	2685.87	3w	Mn II	44	2685.883	19
2682.20	5	Fe I		2682.211	7	2685.99	3	Mn II Mn II— Cr II?	62 68	2685.983 2685.983 2686.00	19 19 UV
2682.36	1	Mn II	63	2682.368	19	2686.11	4w	Fe II	202	2686.100	UV
2682.54	3d	Fe II	425	2682.510	23	2686.19	1w	P I	7	2686.183	55
2682.87	5w	Vd II	3	2682.875	UV	2686.39	4	Fe II	262	2686.388	UV
2682.91	2					2686.51	1	Fe II		2686.482	23
2683.00	2	Fe II	416	2682.989	23	2686.61	3w	Fe?		2686.604	7
2683.07	4	Vd II	3	2683.09	UV	2686.74	5	Fe I		2686.745	51
2683.20	2					2687.09	6w	Cr II—	7	2687.09	UV
2683.44	2W	Cr II	268	2683.45	UV	2687.42	5	Fe I		2687.415	7
2683.72	1W	Fe I		2683.710	7	2687.62	1	Cr II?	84	2687.60	UV
2683.82	2	Mn II	62	2683.833	19	2687.74	3	Zr I?	11	2687.74	UV
2683.94	6	Fe I		2683.936	7	2687.79	5	Fe I		2687.801	7
2684.08	6	Fe I		2684.068	7	2687.94	6	Vd II	3	2687.960	UV
2684.18	3	Zn I	6	2684.161	UV						
2684.26	1	Ni II	63	2684.277	52						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2688.02	4w	P I Cr I	7 18	2688.000 2688.035	55 UV	2691.03	6W	Cr II Cr II	8 85	2691.03 2691.03	UV UV
2688.14	2					2691.16	1				
2688.24	4					2691.34	4	Ge I	1	2691.341	25
2688.28	5	Cr II	84	2688.28	UV	2691.48	4	Fe I		2691.490	7
2688.40	3	Cr II	186	2688.41	UV	2691.64	1				
2688.50	2					2691.75	4d	Mn II Fe II	202	2691.717 2691.732	19 UV
2688.70	5	Vd II	3	2688.717	UV	2691.98	3h	Mn II		2691.981	19
2688.82	2	Ti I		2688.826	58	2692.11	3	Cr II	84	2692.11	UV
2689.04	3	Cr II	84	2689.03	UV	2692.24	4	Fe I	98	2692.248	7
2689.20	7W	Cr II Fe I	85 48	2689.20 2689.212	UV 7	2692.45	2w	Cr I Mg I	18	2692.441 2692.45	UV 44
2689.41	6	Fe I		2689.415	7	2692.61	6D	Fe II Fe I	283 50	2692.601 2692.650	UV 7
2689.48	5	Mg I		2689.50	44	2692.82	6w	Fe II	62	2692.826	UV
2689.68	3	Ti I Ni I	2 71	2689.675 2689.680	58 UV	2692.97	1	Fe		2693.005	7
2689.78	7W	Mn II Cr II	44 188	2689.787 2689.79	19 UV	2693.08	3w				
2689.83		Fe I	99	2689.829	7	2693.18	4	Mn II	34	2693.192	19
2689.88		Vd II	3	2689.883	UV	2693.34	1w	Cr I? Fe	57	2693.315 2693.355	UV 7
2690.07	6	Fe I	4	2690.069	7	2693.54	5	Zr II Cr II	4 84	2693.52 2693.53	UV UV
2690.25	5	Cr I Vd II	18 3	2690.251 2690.252	UV UV	2693.71	4	Mg I	10	2693.723	44
2690.37	3	Fe I		2690.352	43	2693.85	4	Fe II	261	2693.852	UV
2690.42	3	Fe?		2690.422	7	2693.94	2				
2690.50	3W					2694.07	2d	Zr II Fe II	40	2694.05 2694.075	UV 10
2690.62	3	Ti I		2690.612	58	2694.23	4	Fe I	4	2694.239	7
2690.79	5	Vd II	3	2690.792	UV						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2694.38	2 _w	Co I		2694.392	50	2698.14	5D	II Mg I Fe I	10	2698.145 2698.165	44 7
2694.53	6	Fe I	144	2694.536	UV	2698.23	2				
2694.67	5	Co II	13	2694.684	18	2698.39	5 _w	Cr II	7	2698.40	UV
2694.88	2	Cr I	80	2694.887	UV	2698.68	5 _W	Cr II	7	2698.68	UV
2695.02	6	Fe I	47	2695.034	7	2698.76	4				
2695.18	7	Mg I	10	2695.181	44	2698.83	3	Cr II	289	2698.85	UV
2695.32	6d	-Mn II	34	2695.365	19	2698.98	4	Mn II	35	2698.989	19
2695.53	7	Fe I		2695.530	7	2699.09	6	Fe I	48	2699.106	7
2695.63	7	Fe I	145	2695.651	7	2699.17	1	Fe II	416	2699.185	23
2695.85	4	Co I	53	2695.846	UV	2699.32	3	Cr II	141	2699.34	UV
2695.98	6	Fe I		2695.989	7	2699.45	1 _h	Fe		2699.452	7
2696.27	6	Fe I	143	2696.283	7	2699.58	4	Zr II	5	2699.59	UV
2696.37	4					2699.76	4	Fe I	4	2699.775	7
2696.48	5	Ni I	49	2696.484	UV	2700.12	2	Zr II	5	2700.12	UV
2696.53	3	Cr I	8	2696.534	UV	2700.28	2 _h				
2696.75	3	Cr II	84	2696.76	UV	2700.58	4	Cr I	17	2700.590	UV
2696.88	3	Fe?		2696.895	7	2700.72	1				
2697.02	5	Fe I	100	2697.021	7	2700.92	5	Vd II	1	2700.944	UV
2697.19	4	Cr I	17	2697.200	UV	2701.06	4D	Mn II— Cr II	34 62	2701.024 2701.10	19 UV
2697.34	5	Fe II	341	2697.330	UV	2701.17	4	Mn II	35	2701.170	19
2697.48	5D	Fe II Cr II	341 186	2697.453 2697.51	UV UV	2701.45	3				
2697.64	2					2701.52	4	-Vd II	2	2701.535	UV
2697.72	3	Fe II	325	2697.726	UV	2701.64	4	Cr II	62	2701.65	UV
2697.90	5	Cr II Cr II	84 267	2697.90 2697.90	UV UV	2701.68	5	Mn II	18	2701.698	19
2698.03	4					2701.87	3				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2701.91	4	Fe I	161	2701.909	7	2704.72	1	Cr I Fe I	65	2704.744 2704.748	UV 7
2701.99	4	Cr I	18	2701.990	UV		2				
2702.18	4	Vd II	2	2702.185	UV	2705.06	2	Vd II	2	2705.220	UV
2702.28	4	Fe I	155	2702.263	43	2705.20	3				
2702.44	4	Fe I	154	2702.449	7	2705.26	2	Cr I— Ni I	64 48	2705.414 2705.463	UV UV
2702.55	4	Cr I	64	2702.519	UV	2705.44	3d				
2702.69	1					2705.54	2	Mn II	34	2705.561	19
2702.75	2					2705.72	5	Cr I Cr I Mn II	17 18 18	2705.724 2705.724 2705.732	UV UV 19
2702.90	1	Ni II	45	2702.905	52	2705.84	1	Co II		2705.85	57
2702.99	1	Fe I?		2702.97	51	2705.90	1	Pt I	6	2705.88	UV
2703.13	1	Mn I?		2703.129	4	2706.01	7W	Fe I	154	2706.012	UV
2703.24	2	Mn II?	34	2703.22	19	2706.14	5	Vd II	1	2706.17	UV
2703.31	1					2706.52	5	Ni I Cr I	70 64	2706.521 2706.531	UV UV
2703.47	4D	Mn II Cr I	18 18	2703.453 2703.48	19 UV	2706.58	6	Fe II Fe I	341 48	2706.566 2706.582	UV 7
2703.55	5	Cr II	84	2703.56	UV	2706.68	5	Vd II	2	2706.70	UV
2703.62	1	Ni I		2703.615	UV	2706.83	2	Fe		2706.821	7
2703.69	1w	Mn I		2703.658	4	2706.87	4	Fe		2706.879	7
2703.85	6	Cr II	7	2703.85	UV	2707.03	4	Fe		2707.034	7
2703.98	6	Mn II Fe II	18 261	2703.98 2703.988	19 UV	2707.08	3	Ti II		2707.057	56
2704.08	2					2707.13	4	Fe II	339	2707.128	UV
2704.24	1					2707.34	1	Co II?	29	2707.349	18
2704.31	1					2707.45	4	Fe I		2707.448	7
2704.56	3	Fe II	202	2704.569	UV	2707.54	4	Mn II	18	2707.544	19

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2707.68	2h	Cr I?	56	2707.69	UV	2710.54	5	Fe I	100	2710.544	7
2707.86	4	Vd II	2	2707.86	UV	2710.62	1	Mn II		2710.629	19
2708.04	3	Fe I		2708.040	7	2710.68	1				
2708.13	3					2710.83	1	Fe I?		2710.85	51
2708.30	1W					2710.93	2	Cr II	289	2710.92	UV
2708.44	4	Mn II	18	2708.452	19	2711.05	3	Fe		2711.051	7
2708.57	5	Fe I	161	2708.571	7	2711.19	3w	Cr II	187	2711.19	UV
2708.64	5	Fe		2708.653	7	2711.27	1	Fe I	98	2711.265	43
2708.70	2	Fe II		2708.713	10	2711.40	1				
2708.79	4	I Cr II— Mn II	186 18	2708.78 2708.814	UV 19	2711.47	5	Zr II	4	2711.48	UV
2708.88	3	Fe		2708.890	7	2711.56	2	Mn II	18	2711.568	19
2709.05	5	Fe II	218	2709.051	UV	2711.65	6	Mn II Fe I	18 47	2711.630 2711.655	19 7
2709.20	1					2711.74	5	Vd II	2	2711.740	UV
2709.31	3	Cr II	186	2709.31	UV	2711.84	5	Fe II	201	2711.842	UV
2709.37	4	Fe II	62	2709.373	UV	2712.31	5	Cr II	7	2712.30	UV
2709.62	4	Ge I	1	2709.624	25	2712.39	4	Fe II	201	2712.386	UV
2709.71	1	Fe I	180	2709.691	7	2712.49?	1	Zn I	6	2712.488	UV
2709.82	2					2712.68	1	Fe?		2712.685	7
2709.93	2	Fe II	340	2709.937	23	2712.87	1	Cr II	289	2712.85	UV
2709.98	5	Mn II— I Fe I	18 144	2709.970 2709.989	19 UV	2713.04	2	Vd II	2	2713.050	UV
2710.13	1					2713.28	1				
2710.22	2	Cr I?		2710.19	28	2713.33	3	Mn I	11	2713.320	UV
2710.32	4	Mn II	18	2710.336	19	2713.44	3	Fe		2713.445	7
2710.41	4d	Mn II— Fe	18	2710.392 2710.417	19 7	2713.64	1	Fe II		2713.661	23
						2713.79	2h	I Ti II Fe II?	13	2713.795 2713.819	56 10

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2714.07	4	Fe I	161	2714.059	7	2717.96	2				
2714.19	4	Vd II	2	2714.205	UV	2718.07	2w	Cr I	17	2718.07	UV
2714.42	7W	Fe II	63	2714.414	UV			Cr II	187	2718.08	UV
2714.88	6	Fe I	48	2714.869	7	2718.34	5	Cr II	102	2718.32	UV
2715.12	3	Fe I		2715.120	7	2718.44	6	Fe I	48	2718.436	7
2715.32	4	Fe I	4	2715.320	7	2718.64	3	Fe II	417	2718.639	23
2715.41	4	Fe		2715.405	7	2719.04	8W	IFe I— Fe I	5 161	2719.028 2719.060	7 7
2715.52	3	Fe I		2715.500	7	2719.31	4	IFe II Mn II	339	2719.296 2719.307	UV 19
2715.65	4	Vd II Vd II	1 1	2715.676 2715.676	UV UV						
2715.74	2					2719.42	5	Fe I	154	2719.420	7
2716.01	4	Co I Fe	131	2715.987 2716.002	UV 7	2719.58	3	Co I Fe	108	2719.581 2719.592	UV 7
2716.23	6D	Fe II— Fe I	261 155	2716.216 2716.258	UV 7	2719.74	4	Mn II	33	2719.743	19
2716.42	3	Fe I Fe II	154 339	2716.418 2716.429	7 UV	2719.91	2	Mn II		2719.895	19
2716.69	4	Fe II	62	2716.683	UV	2720.00	2	Mn II	33	2720.003	19
2716.78	2	Mn II	33	2716.796	19	2720.07	3	Cr II	102	2720.06	UV
2716.89	1					2720.21	5	Fe I	129	2720.197	7
2717.05	1W					2720.26	3	Cr II	102	2720.25	UV
2717.13	2	Fe I		2717.134	43	2720.53	4	Fe I	4	2720.519	7
2717.31	4	Ti II	15	2717.304	UV	2720.90	7W	Fe I	5	2720.903	7
2717.36	4	Gd III Fe I		2717.357 2717.366	3 7	2721.11	5	Fe I		2721.108	7
2717.51	5	Cr II Mn II Fe II	7 33 32	2717.51 2717.527 2717.533	UV 19 UV	2721.33	2w				
2717.79	5	Fe I	49	2717.786	7	2721.64	3	Ca I		2721.645	45
						2721.80	4	Fe II	199	2721.813	UV
						2722.05	5D	Fe I Fe II	97 260	2722.039 2722.060	7 UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2722.23	3					2726.13	4	Mn I	11	2726.13	UV
2722.32	4					2726.24	5	I Fe I Cr II	161 162	2726.235 2726.26	7 UV
2722.43	1					2726.35	2				
2722.60	3	Zr II	3	2722.62	UV	2726.51	5	Zr II Cr I Fe II	4 7 261	2726.48 2726.496 2726.509	UV UV UV
2722.74	5	I Cr II Fe II	7 416	2722.74 2722.740	UV 23	2726.57	2	Vd II	47	2726.544	UV
2722.80	2					2726.69	3				
2723.02	3	Fe I	154	2723.032	29	2726.79	3	Fe II?		2726.809	23
2723.21	4	Vd II	1	2723.218	UV	2726.91	1	Fe II		2726.936	10
2723.37	3	Fe II		2723.390	10	2727.25	4	Cr II	102	2727.25	UV
2723.58	6W	Fe I	5	2723.578	7	2727.39	5	I Fe II— Ti I	200 32	2727.382 2727.420	UV 58
2723.78	4					2727.55	7W	Fe II	63	2727.538	UV
2723.89	2w	Fe II		2723.893	10	2728.03	6	Fe I	47	2728.020	7
2724.03	3d	Cr II	102	2724.04	UV	2728.16	2	Cr II	162	2728.17	UV
2724.16	1h					2728.23	1				
2724.33	5	Fe I	144	2724.339	7	2728.45	1H				
2724.43	4	Mn II	33	2724.465	19	2728.63	4	Vd II	1	2728.644	UV
2724.66	4	Fe I		2724.670	7	2728.82	5	Fe I	154	2728.820	7
2724.92	6D	Fe II Fe I	62 48	2724.879 2724.953	UV 7	2728.91	4	Fe II	260	2728.898	UV
2725.09	3	Ti I	32	2725.081	58	2728.97	5	Fe I	4	2728.969	7
2725.33	5w	Fe I	98	2725.329	7	2729.32	1	Fe II		2729.338	23
2725.61	5	Fe I	48	2725.601	7	2729.43	2	Fe II	220	2729.427	UV
2725.80	5	Ti II Fe I	15 161	2725.79 2725.805	UV UV	2729.55	1	Fe II	417	2729.569	23
2725.95	3	Mn II	34	2725.932	19	2729.71	1	Cr II?	162	2729.73	UV
2726.06	6	Fe I	48	2726.055	7	2729.81	1				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2730.02	3					2733.36	3	Fe I		2733.364	43
2730.12	3					2733.49	5	Mg I	9	2733.493	44
2730.26	3	Fe I		2730.265	29	2733.58	6W	Fe I	46	2733.581	7
2730.38	2					2733.90	3	Vd II	1	2733.906	UV
2730.50	2					2734.00	5	Fe I	48	2734.005	7
2730.73	6W	Fe II	62	2730.735	UV	2734.05	3				
2730.98	5	Fe I	48	2730.982	7	2734.27	5	Fe I	125	2734.268	7
2731.11	2	Co I	140	2731.112	UV	2734.44	4				
2731.28	4	Fe I	161	2731.281	UV	2734.62	4	Fe I	47	2734.616	7
2731.33	2	Vd I	85	2731.347	UV	2734.86	5	Zr II	4	2734.84	UV
2731.40	2					2735.01	5d				
2731.56	1	Ti I	32	2731.583	58	2735.28	4	Ti I	32	2735.283	58
2731.73	2					2735.32	3	Fe I	98	2735.319	43
2731.85	2	Fe II Fe I	154	2731.841 2731.849	10 43	2735.47	6	Fe I	46	2735.475	7
2731.91	5	Cr I	7	2731.895	UV	2735.61	5	IFe I Ti I	125 26	2735.612 2735.613	7 UV
2732.00	5w	Mg I Fe II	9 236	2731.993 2732.004	44 UV	2736.20	4				
2732.11	3					2736.50	6D	ICr I Fe II IMg I	7 220 9	2736.463 2736.500 2736.542	UV UV 44
2732.32	3	Fe II		2732.328	10	2736.75	5				
2732.45	4	Fe II	32	2732.441	UV	2736.88	5				
2732.59	1					2736.97	6W	Fe I Fe II	49 63	2736.964 2736.968	7 UV
2732.72	2	Zr II	5	2732.72	UV	2737.09	2	Cr II Cr II	120 253	2737.09 2737.09	UV UV
2732.78	3	Fe I		2732.778	29	2737.30	6W	Fe I	5	2737.310	7
2732.90	4	-Fe II	417	2732.936	23	2737.57	2				
2733.18	1					2737.63	4	Fe II Fe I	200 153	2737.630 2737.640	UV 7
2733.25	2	Ti I	32	2733.264	58						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2737.83	4	Fe I		2737.832	7	2741.56	4	Zr II	5	2741.54	UV
2738.21	3	Fe I	48	2738.214	7			IFe I	98	2741.577	7
2738.27	2	Fe I		2738.276	43	2741.66	1	Fe II		2741.673	23
2738.45	3	Fe I?		2738.44	51	2742.02	6	Fe I	4	2742.016	7
2738.50	2h							Cr II	6	2742.02	UV
2738.86	1	Mn I		2738.861	4	2742.15	3	Cr I	63	2742.165	UV
2738.98	1	Fe I	95	2738.955	43	2742.24	6	Fe I	46	2742.254	7
2739.10	2	Fe I		2739.109	43	2742.32	5	Ti I	25	2742.297	58
2739.23	2					2742.40	6W	Fe I	5	2742.406	7
2739.56	8W	Fe II	63	2739.545	UV	2742.45	3	Vd II	1	2742.43	UV
2739.71	2	Vd II	1	2739.715	UV	2742.55	3	Zr II	4	2742.54	UV
2739.80	2	Ti I	32	2739.808	58	2742.67	3	Vd II	13	2742.670	UV
2740.09	5	Cr II	6	2740.09	UV	2742.73	1	Mn I		2742.735	4
2740.24	2h					2743.20	7W	Fe II	62	2743.196	UV
2740.33	1	Zr II	12	2740.33	UV	2743.56	5	Fe I	47	2743.565	7
2740.44	3	Ge I	23	2740.426	25	2743.64	5	Cr II	6	2743.63	UV
		Co I	109	2740.457	UV	2743.75	2h	Vd II	13	2743.768	UV
2740.49	1	Zr II	19	2740.49	UV	2743.94	2	Cr II?—	184	2743.94	UV
2740.68	3					2744.06	6w	Fe I	5	2744.068	7
2740.88	4					2744.25	4	Fe II	32	2744.265	38
2740.98	3					2744.33	3				
2741.06	3	Fe II	418	2741.045	23	2744.52	5	Fe I	46	2744.527	7
		Cr I	63	2741.078	UV	2744.68	1	Fe II		2744.691	10
2741.10	4	Fe I	181	2741.102	7	2744.78	2h				
2741.21	3					2744.89	3	Fe II	260	2744.890	UV
2741.36	5D	Fe I	180	2741.325	43	2744.96	3	Cr II	58	2744.97	UV
		Fe II	260	2741.395	UV	2745.00	3	Fe I		2745.017	43

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2745.08	4	Fe I		2745.081	51	2748.24	3	Au I Cr I	4 15	2748.24 2748.275	UV UV
2745.29	1w	Fe II		2745.297	23	2748.32	3				
2745.42	1w	Cr II	185	2745.41	UV	2748.98	6	Cr II	6	2748.98	UV
2745.55	1w	Fe II Mn I		2745.534 2745.549	10 4	2749.18	7W	Fe II	63	2749.178	UV
2745.67	1	Fe II		2745.668	10	2749.32	7W	Fe II	62	2749.324	UV
2745.76	1					2749.48	6W	Fe II	63	2749.482	UV
2745.81	4	Fe I?		2745.817	51	2749.68	5	Fe I	49	2749.688	29
2745.87	3h	Zr II	3	2745.86	UV	2749.81	2	Cr II	253	2749.82	UV
2745.96	4	Fe I		2745.952	29	2750.03	5	Fe II	199	2750.003	UV
2746.00	3	Co I	108	2746.028	UV	2750.14	6W	Fe I	5	2750.140	7
2746.14	2d	Cr II Fe II	138 373	2746.15 2746.157	UV UV	2750.41	2h				
2746.21	2	Cr II Cr II	58 253	2746.21 2746.21	UV UV	2750.50	1h	Fe II		2750.501	10
2746.49	7W	Fe II	62	2746.487	UV	2750.72	6d	Fe I Cr II	125 6	2750.697 2750.72	7 UV
2746.74	5	Ti II Ni I	31 26	2746.721 2746.743	56 UV	2750.88	5d	Fe I Fe II	128 200	2750.874 2750.896	7 UV
2746.98	7W	Fe II Fe I	63 45	2746.978 2746.982	UV 7	2751.05	1				
2747.30	1W	Fe I	179	2747.316	7	2751.12	4	Fe II	217	2751.121	UV
2747.46	1	Vd II	135	2747.462	UV	2751.19	2h				
2747.53	5	Fe I Fe I	95 125	2747.555 2747.555	7 7	2751.32	3	Fe I		2751.325	29
2747.66	3h					2751.59	3	Cr I	15	2751.58	UV
2747.77	1	Cr II	185	2747.76	UV	2751.70	1	Ti II	31	2751.70	UV
2747.93	1h	Cr II?		2747.94	UV	2751.86	6w	Cr II	6	2751.85	UV
2748.16	2					2752.18	3h	Fe II— Zr II	373 3	2752.159 2752.21	UV UV
						2752.36	1h	Cr II	253	2752.37	UV
						2752.45	1				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2752.56	1	Fe II?		2752.542	10	2756.50	4	Fe II	200	2756.504	UV
2752.68	1 <i>h</i>					2756.59	3	Fe II		2756.622	10
2752.86	4	Cr I	15	2752.851	UV	2756.73	1 <i>w</i>	Cr I?	79	2756.77	UV
2753.04	1	Fe II	417	2753.034	23	2756.87	3	Cr II	101	2756.89	UV
2753.10	4	Fe I		2753.098	7	2756.96	2	Cr II	100	2756.96	UV
2753.28	6	Fe II	235	2753.289	UV	2757.03	4	Fe II	199	2757.029	UV
2753.40	3 <i>w</i>	Vd II	150	2753.407	UV	2757.08	4	Cr I	15	2757.086	UV
2753.69	5	Cr II	58	2753.66	UV	2757.32	5	Fe I	46	2757.316	7
		Cr II	101	2753.66	UV						
		Fe I	46	2753.686	7	2757.42	4	Fe I	95	2757.422	7
2753.80	4					2757.53	3	Fe I		2757.535	7
2753.86	4					2757.72	5	Cr II	6	2757.72	UV
2753.98	4					2757.86	4	Fe I		2757.858	7
2754.03	5	Fe I	47	2754.032	7	2758.08	3	Ti I	35	2758.066	58
2754.26	4 <i>H</i>	Cr II	101	2754.28	UV	2758.23	2	Cr I	79	2758.236	UV
								Cr I	101	2758.236	UV
2754.43	4	Fe I	47	2754.426	7	2758.54	1 <i>h</i>	Vd II	13	2758.53	UV
2754.59	4	Ge I	1	2754.588	25			Vd II	65	2758.53	UV
2754.83	3	Cr I	79	2754.821	UV	2758.80	3	Zr II	3	2758.80	UV
2754.94	5 <i>d</i>	Fe II	373	2754.907	UV	2758.97	4	Cr II	252	2758.99	UV
		Fe I		2754.942	7						
2755.07	3	Fe I	153	2755.055	43	2759.18	2	Fe I		2759.174	43
		Fe II	373	2755.088	UV	2759.32	} 5 <i>d</i>	Fe II	32	2759.336	UV
2755.18	5	Fe I	153	2755.181	7	2759.38		Cr II	101	2759.40	UV
2755.74	8 <i>W</i>	Fe II	62	2755.733	UV	2759.51	4	Fe II		2759.501	10
2756.08	4	Fe		2756.086	7	2759.71	4	Cr II	101	2759.73	UV
2756.31	7 <i>D</i>	II Fe I	4	2756.267	7	2759.81	5	Fe I	47	2759.813	7
		Cr II	101	2756.30	UV						
		II Fe I	5	2756.328	7	2759.91	4				
						2760.04	3	Cr II	184	2760.04	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2760.11	3	Vd II	77	2760.122	UV	2763.08	5	Cr I	79	2763.09	UV
2760.19	3	Mg I		2760.170	38			Cr I	101	2763.09	UV
		Cr II	101	2760.20	UV			II Fe I	47	2763.109	7
2760.35	4	Cr II	100	2760.36	UV	2763.31	3				
2760.51	3	Cr II	253	2760.53	UV	2763.49	4	Fe II	32	2763.504	38
2760.62	4	Fe I	127	2760.623	29	2763.57	3	Cr II	101	2763.59	UV
2760.69	3	Vd II	149	2760.710	UV	2763.69	2	Fe II	440	2763.674	UV
2760.90	5d	Fe I		2760.891	7	2763.77	1				
		Mn I	9	2760.920	UV	2763.90	4	Fe II	199	2763.913	UV
		Mn II		2760.92	19	2764.14	5D	Fe I		2764.118	7
2761.15	1	Fe II—		2761.128	UV			Mg II		2764.137	38
		Fe II		2761.178	23			Fe II		2764.149	10
2761.28	3	Ti II	12	2761.299	56	2764.33	6w	Fe I	128	2764.323	UV
2761.35	3	Co I	52	2761.366	UV			Cr I	15	2764.355	UV
2761.49	3	Fe I	140	2761.480	7	2764.80	5	Fe II—	198	2764.787	UV
		Fe II		2761.498	10			Ti II	12	2764.821	UV
2761.67	1	Fe I		2761.678	43	2764.92	2				
2761.73	} 7w	Cr I	15	2761.735	UV	2765.22	5	Mg I	8	2765.222	44
2761.79		Fe I	46	2761.780	7	2765.44	5d	Cr II	100	2765.46	UV
		Fe II	63	2761.813	UV			Fe II	324	2765.493	UV
2762.02	7	Fe I	46	2762.026	7	2765.62	4	Cr II	59	2765.62	UV
2762.22	3	Ti II	12	2762.22	UV	2765.67	5	Vd II	46	2765.676	UV
2762.32	3	Fe II	373	2762.340	UV			Vd II	218	2765.676	UV
2762.44	3	Fe II	199	2762.436	UV			II Fe I	92	2765.70	UV
2762.58	6	Cr II	6	2762.58	UV	2765.86	3	Cr II	260	2765.86	27
2762.67	5	Fe		2762.681	7	2766.03	3	Fe I	179	2765.991	7
2762.76	5	I Fe I	125	2762.772	7			Fe I	160	2766.03	UV
		Cr II	100	2762.78	UV	2766.08	4	Fe I	97	2766.078	43
2762.90	4	Fe I		2762.890	43	2766.20	4	Fe II	324	2766.200	UV
								Co I	131	2766.215	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2766.39	5	Cu I Co I Cr I	18 52 93	2766.371 2766.382 2766.39	UV UV UV	2769.56	3	Fe II	199	2769.566	UV
						2769.66	5	Fe I	44	2769.671	7
2766.46	4	Vd II	77	2766.460	UV	2769.90	5	Cr I	15	2769.902	UV
2766.53	6	Cr II	6	2766.55	UV	2770.04	3				
2766.65	5	Fe I		2766.659	7	2770.15	2				
2766.91	5	Fe I	47	2766.910	7	2770.29	2	Fe II	337	2770.303	23
2767.25	2	Cr II	266	2767.26	UV	2770.40	3				
2767.35	2					2770.51	5	Fe II Fe II	198 199	2770.507 2770.507	UV UV
2767.50	6 W	Fe II Fe II Fe I	235 373 46	2767.500 2767.500 2767.522	UV UV 7	2770.59	4	Fe		2770.575	7
2767.80	2	Fe I	153	2767.813	43	2770.69	4	Fe I	123	2770.695	UV
2767.92	1	Fe I	153	2767.940	43	2770.84	3	Fe I	3	2770.847	43
2768.01	1					2770.97	2				
2768.10	5	Fe I		2768.105	7	2771.05	1	Fe I		2771.050	43
2768.33	5	Fe II Mg I	338 8	2768.334 2768.339	UV 44	2771.18	4	Fe II	282	2771.184	UV
2768.43	5	Fe I Mn II	126 83	2768.432 2768.456	UV 19	2771.30	2d	Cr II? Fe II?	251	2771.27 2771.314	UV 10
2768.56	5	Vd II Cr II	46 252	2768.566 2768.59	UV UV	2771.43	3	Mn I	8	2771.430	UV
2768.72	2	Zr II	4	2768.73	UV	2771.55	4	Fe II	197	2771.553	UV
2768.84	2	Zr II Fe II	4 324	2768.84 2768.848	UV UV	2771.64	1	Pt I	3	2771.65	UV
2768.93	6	Fe II	63	2768.940	UV	2771.72	2				
2769.15	5	Fe II	200	2769.153	UV	2771.88	5	Fe I		2771.880	7
2769.28	5	Fe I	151	2769.297	UV	2772.10	6d	Fe I Fe I	45 5	2772.074 2772.110	7 7
2769.35	5	Fe II	198	2769.354	UV	2772.32	5	Fe I		2772.318	7
						2772.51	5	Fe I		2772.508	7
						2772.72	5	Fe II	63	2772.719	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2772.82	4	Fe I	179	2772.826	7	2776.69	7W	Mg I	6	2776.690	44
2773.02	2	Mn II?	46	2773.043	19	2776.77	4	Fe II		2776.783	10
2773.22	5	Fe I		2773.232	UV	2776.85	2				
2773.30	4	Cr II	58	2773.30	UV	2776.90	3	Fe II	373	2776.923	UV
2773.45	3					2777.27	2h				
2773.67	2	Fe II	338	2773.678	UV	2777.43	2				
2773.89	4	Fe I	151	2773.903	7	2777.60	3	Fe II	32	2777.587	38
2774.02	4					2777.73	4	Vd II	77	2777.748	UV
2774.16	3	Zr II I Fe I	40 127	2774.15 2774.161	UV 7	2777.84	3	Fe II	281	2777.840	UV
2774.26	3	Vd II	46	2774.28	UV	2777.89	5	Fe II	233	2777.892	23
2774.42	3	Cr II	266	2774.44	UV	2778.08	5	Cr II Fe I	266	2778.06 2778.067	UV 7
2774.72	5d	Fe II Fe I Fe II	218 46 32	2774.686 2774.730 2774.732	UV 7 38	2778.13	4	Mg I	7	2778.13	44
2774.93	5	Fe I Co I	179 52	2774.938 2774.960	7 UV	2778.25	7	Fe I IMg I	44 6	2778.220 2778.270	7 44
2775.22	3	Fe I		2775.233	43	2778.56	4	Mn I	9	2778.544	UV
2775.33	4	Fe II	32	2775.339	UV	2778.75	4				
2775.44	3					2778.84	5	Fe I		2778.841	7
2775.64	3	Mn II Cr I	73 93	2775.652 2775.668	19 UV	2778.93	3	Fe I		2778.927	43
2775.78	4	-Vd II	148	2775.770	UV	2779.15	3	Cr I	93	2779.134	UV
2775.84	4	Fe I		2775.844	7	2779.30	6	Fe II	234	2779.302	UV
2776.19	5	Fe II Mn I	199 9	2776.180 2776.218	UV UV	2779.84	7W	IMg I IMg I Fe II	6 6 348	2779.831 2779.831 2779.906	44 44 UV
2776.42	6d	Fe I- Fe I		2776.397 2776.448	7 7	2780.02	3w	Mn I Fe II	13 348	2779.993 2780.035	4 UV
2776.53	4	-Fe II?		2776.554	10	2780.30	4	Cr II Cr II	183 252	2780.30 2780.30	UV UV
						2780.55	5w	Ti II-	8	2780.522	56

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2780.70	5	II Cr I Fe I	15 160	2780.695 2780.698	UV 7	2784.27	4	Fe II	295	2784.282	UV
2780.88	4	Fe I Cr II	45 58	2780.883 2780.89	7 UV	2784.33	5	Fe I	152	2784.343	7
2781.00	4					2784.50	4h	Fe II	373	2784.484	UV
2781.05	3	Cr II	260	2781.07	UV	2784.64	4	Ti II	8	2784.648	UV
2781.15	1	Cr I	93	2781.15	UV	2784.83	4	Fe II		2784.833	10
2781.29	6	Mg I	7	2781.288	44	2785.02	5	Fe II	32	2785.024	38
2781.42	7	Mg I	6	2781.416	44	2785.12	5	Cr II Fe	99	2785.10 2785.127	UV 7
2781.84	5	Fe I	46	2781.836	7	2785.21	5	Fe II	373	2785.213	UV
2782.06	4	Fe I	126	2782.053	7	2785.34	2				
2782.15	2h	Mn II	72	2782.145	19	2785.59	2				
2782.37	3h	Cr II	183	2782.36	UV	2785.69	5	Cr II	183	2785.69	UV
2782.58	2	Cr II	257	2782.59	UV	2785.77	4	Fe II	295	2785.800	UV
2782.74	3	Mn I	7	2782.711	4	2786.17	5	Fe I	123	2786.18	UV
2782.98	7	Mg I	6	2782.972	44	2786.46	4	Cr II—	252	2786.46	UV
2783.10	4	Mn I? Fe II		2783.080 2783.095	4 10	2786.58	2				
2783.36	3					2786.79	5	Fe I		2786.781	7
2783.42	3	Fe II	337	2783.410	23	2787.12	3	Fe I	151	2787.12	UV
2783.54	4	Fe I	95	2783.551	7	2787.22	4	Fe II	380	2787.241	7
2783.70	6	Fe II	234	2783.690	UV	2787.62	5	Cr II	58	2787.61	UV
2783.85	4	Cr II Fe I	252	2783.84 2783.845	UV 29	2787.82	4	Mn I	9	2787.813	UV
2784.00	5	Fe II Fe I	295 160	2783.959 2784.009	UV 7	2787.93	6	Cr II II Fe I	259 93	2787.90 2787.932	UV 7
2784.21	3	Mn II	83	2784.208	19	2788.11	7W	Fe I	44	2788.104	7
						2788.99	2				
						2789.11	3	Cr II?	99	2789.08	UV
						2789.20	3	Mn I	8	2789.192	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2789.38	3d	Mn I	9	2789.355	UV	2797.19	2	Fe II	436	2797.215	23
		Cr II	276	2789.39	UV						
		Cr II	327	2789.39	UV	2797.77	5	Fe I	45	2797.775	7
2789.48	6	Fe I	125	2789.477	UV	2797.93	6	Fe II	234	2797.914	UV
2789.67	4	Fe II		2789.675	10			IMg II	3	2797.93	38
2789.83	5D	IFe I— Fe	170	2789.802	7	2798.02	6	Mg II	3	2797.998	46
				2789.847	7	2798.26	6	Mn I	1	2798.270	UV
2789.95	4	Mn II	72	2789.982	19	2798.65	5	Cr II		2798.65	UV
2790.33	3d	Mn I	8	2790.353	UV			INi I	26	2798.651	UV
2790.56	3d	Mg II		2790.542	38	2798.76	3	Vd II	100	2798.755	UV
		Fe II	282	2790.557	UV			Cr II	117	2798.77	UV
2790.77	7	Fe II	32	2790.752	UV	2799.15	4	Fe I		2799.146	7
		IMg II	3	2790.776	46	2799.30	3h	Fe II	233	2799.292	23
2790.98	4d	Fe I?— Fe II	160 232	2790.942	43	2799.47	2	Vd II	62	2799.451	UV
				2791.001	UV	2799.84	4w	Mn I	6	2799.841	UV
2791.09	2	Mn I	6	2791.085	UV	2800.47	3	Fe I		2800.467	7
		Mg II		2791.117	38	2800.77	2	Cr II	182	2800.77	UV
2791.20	2					2801.08	6	Mn I	1	2801.084	UV
2791.45	4	Fe I		2791.454	7	2801.28	3				
2791.51	4					2802.70		Mg II	1	2802.704	46
2791.79	5	Fe I	151	2791.786	UV	2803.18	4	Fe I	3	2803.166	7
2792.16	2	Cr II	183	2792.16	UV	2803.61	3	IFe I	151	2803.613	UV
2792.39	5	Fe I	95	2792.399	7			Mn I	8	2803.623	4
2793.89	4	Fe II	198	2793.887	UV	2804.52	5	Fe I	44	2804.521	7
2794.69	3	Fe I	46	2794.702	7	2804.86	3h	Fe I	170	2804.862	7
2794.82	6	Mn I	1	2794.817	UV			Fe I	151	2804.883	43
2795.00	4	Fe I	3	2795.005	7	2805.07	4	Ni I	1	2805.078	UV
2795.53		Mg II	1	2795.528†	46	2805.37	2	Mn II	66	2805.364	19
2796.87	2	Fe I	96	2796.871	UV	2805.81	3	Fe II	259	2805.786	UV
								Fe I	92	2805.808	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2806.08	3	Fe I	139	2806.070	7	2810.99	2				
2806.29	2W					2811.08	2	Mg I		2811.112	44
2806.48	2h	Ti II? Fe I?	176	2806.495 2806.500	56 43	2811.16	3	Fe I Cr I	92 54	2811.162 2811.169	7 UV
2806.68	2h					2811.28	3	Fe II Mn II	196 51	2811.269 2811.283	UV 19
2806.99	5	Fe I	45	2806.984	7	2811.59	1	OH	(1-0)	2811.591	8
2807.08	3	Fe I	90	2807.073	43	2811.69	2				
2807.19	3H	Fe II Fe II	295 281	2807.165 2807.165	UV UV	2811.80	3	Mg I OH	(1-0)	2811.781 2811.797	44 8
2807.24	4	Fe I	2	2807.245	7	2812.02	5	Cr II Cr II Fe I	182 257 170	2812.00 2812.00 2812.042	UV UV UV
2807.88	3					2812.16	1	OH	(1-0)	2812.162	8
2808.00	2h	Mn I Cr II	6	2808.015 2808.02	UV UV	2812.23	3d	-Mn II	71	2812.264	19
2808.34	4d	Fe I— Ni II?	45 26	2808.327 2808.343	7 52	2812.31	4	Fe I	96	2812.31	UV
2808.64	3	Fe I		2808.665	29	2812.50	4	Fe II	215	2812.493	UV
2808.81	2	Fe I		2808.79	51	2812.60	3	Mn II OH	71 (1-0)	2812.588 2812.591	19 8
2808.94	2					2812.84	3	Mn I	8	2812.840	UV
2809.12	3	Mn I	6	2809.103	UV	2812.93	3h				
2809.77	3D	Mg I Fe II	380	2809.761 2809.804	44 UV	2813.07	4				
2810.15	2	Vd II	120	2810.158	UV	2813.16	4				
2810.22	3	Mn II	71	2810.247	19	2813.29	6	Fe I	44	2813.287	7
2810.28	5	Vd II Ti II	120 25	2810.272 2810.276	UV UV	2813.35	3				
2810.42	3					2813.47	3	Mn I	8	2813.489	4
2810.67	1w					2813.62	4	Fe II	198	2813.613	UV
2810.84	4	Fe I Co II		2810.834 2810.859	29 18	2813.77	2	OH	(1-0)	2813.776	8
						2813.99	2	Mn I	7	2813.989	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2814.20	1w	Fe I	176	2814.210	43	2817.50	5	IFe I Vd II	44 120	2817.504 2817.506	7 UV
2814.37	3	Ni I	79	2814.354	UV	2817.57	2	OH	(1-0)	2817.580	8
2814.54	2h	Cr I	100	2814.52	UV	2817.63	3				
2814.67	1h	Fe I	176	2814.678	43	2817.77	3w				
2814.89	2h	Zr I	4	2814.91	UV	2817.88	2	Ti I Ti II	29 25	2817.835 2817.838	58 UV
2815.01	4	Fe I Mn II	138 66	2815.014 2815.025	7 19	2817.96	5	ICr II Mn I	182 6	2817.96 2817.969	UV UV
2815.34	3h	OH	(1-0)	2815.368	8	2818.07	1	W I?	14	2818.060	UV
2815.53	5	IFe I— Co I	95 52	2815.508 2815.555	7 UV	2818.36	4	Cr II	182	2818.36	UV
2815.84	2w	Fe I		2815.836	29	2818.49	1	Cr I	75	2818.47	UV
2816.00	4	OH OH	(1-0) (1-0)	2815.989 2816.024	8 8	2818.59	3h	Co I	2	2818.592	UV
2816.16	3	IMo II Al II	4 7	2816.153‡ 2816.185	UV 26	2818.68	2	OH	(1-0)	2818.677	8
2816.35	4	Mn II	51	2816.329	19	2818.76	4	Mn I—	8	2818.770	UV
2816.44	1	OH	(1-0)	2816.423	8	2818.90	3h	—Mn I?	8	2818.919	UV
2816.54	1	OH	(1-0)	2816.549	8	2818.97	1h				
2816.68	4d	Fe I? Cr I	 75	2816.67 2816.684	51 UV	2819.14	3	OH OH	(1-0) (1-0)	2819.145 2819.145	8 8
2816.77	4					2819.30	5D	Fe I Fe II	170 196	2819.303 2819.327	7 UV
2816.82	3	Cr II Cr II	58 81	2816.83 2816.83	UV UV	2819.44	4	Fe I		2819.462	29
2816.97	2d	Cr I Cr II?	76 307	2816.95 2817.00	UV UV	2819.60	2	Fe II		2819.589	23
2817.04	2	Yt III	3	2817.037‡	13	2819.73	3h				
2817.10	2h	Fe II	380	2817.107	UV	2819.80	4	OH	(1-0)	2819.822	8
2817.24	2					2820.00	3w	Co I Co I	1 109	2820.002 2820.002	UV UV
2817.35	3d	OH— OH	(1-0) (1-0)	2817.319 2817.380	8 8	2820.19	4	Fe I		2820.20	51
						2820.36	4	Ti II	7	2820.36	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2820.50	4	OH	(1-0)	2820.501	8	2823.99	3	Fe II?		2824.007	10
2820.67	3	OH	(1-0)	2820.669	8	2824.12	1h	OH	(1-0)	2824.096	8
2820.80	5	Fe I	2	2820.803	7	2824.23	2	Fe II?		2824.213	10
2820.92	3					2824.37	4	Cu I OH	17 (1-0)	2824.370 2824.393	UV 8
2821.00	4	Fe I?		2821.009	51	2824.45	1	Ir I	5	2824.448	UV
2821.12	2	Vd II	86	2821.124	UV	2824.53	2	Cr II?		2824.54	UV
2821.29	6	Ni I	25	2821.291	UV	2824.61	3	Fe II	399	2824.589	UV
2821.45	3	Mn I Mn I	6 6	2821.452 2821.452	UV UV	2824.69	4	Fe I	170	2824.700	7
2821.54	2					2824.84	1				
2821.63	4	Fe I	134	2821.63	UV	2824.93	1	Fe I	169	2824.946	43
2821.71	2	OH	(1-0)	2821.706	8	2825.14	1	Co I?		2825.15'	50
2821.88	4	Fe I?		2821.88	51	2825.22	4	Ni II? Co II	25	2825.231 2825.245	52 18
2822.02	4	Cr II	182	2822.01	UV	2825.31	3				
2822.16	2					2825.47	4	Cr II	83	2825.50	UV
2822.26	1					2825.56	6	OH Fe I	(1-0) 45	2825.545 2825.556	8 7
2822.37	5	II Cr II OH	82 (1-0)	2822.38 2822.404	UV 8	2825.68	6	Fe I	3	2825.687	7
2822.55	4	Mn I	6	2822.549	UV	2825.75	4	Fe II	195	2825.747	UV
2822.68	4h	Fe II OH	231 (1-0)	2822.668 2822.705	UV 8	2825.80	2	OH	(1-0)	2825.802	8
2822.80	4	OH	(1-0)	2822.787	8	2826.01	5d	Fe I Fe II	3 255	2825.994 2826.024	7 UV
2823.13	1					2826.14	3	Cr II	182	2826.15	UV
2823.29	6w	Fe I	44	2823.276	7	2826.31	2	Fe I		2826.329	43
2823.50	3	Fe I		2823.507	43	2826.36	1				
2823.65	1d					2826.48	4	Fe I	92	2826.497	7
2823.74	1h					2826.66	3	OH	(1-0)	2826.674	8

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2826.73	2 _w	Cr I	100	2826.734	UV	2830.32	3	Pt I OH	1 (1-0)	2830.29 2830.339	UV 8
2827.06	4	Fe I?		2827.09	51	2830.46	5	Cr II	82	2830.46	UV
2827.11	1	Ti I?		2827.109	58	2830.60	4	Cr II	81	2830.60	UV
2827.24	1 _h					2830.77	4 _D	Fe I Mn I Mn I	 6 6	2830.754 2830.793 2830.793	29 UV UV
2827.41	5	Fe II	231	2827.431	UV	2830.94	5	Fe II	280	2830.939	UV
2827.57	5	Fe I		2827.590	43	2831.04	2 _W	Cr I	88	2831.039	UV
2827.66	3	Fe I	169	2827.67	UV	2831.56	5	Fe II	217	2831.562	UV
2827.74	1					2831.84	3	OH	(1-0)	2831.838	8
2827.88	6	Fe I	3	2827.892	7	2831.99	1 _W	Fe I	170	2831.978	43
2828.05	3					2832.19	5	Ti II OH	7 (1-0)	2832.178 2832.222	56 8
2828.15	1	Ti II— Cr I	25 54	2828.150 2828.167	UV UV	2832.28	3	Fe II	347	2832.270	UV
2828.25	3	Fe I?		2828.26	51	2832.45	6 _W	IFe I Cr II	44 195	2832.436 2832.45	7 UV
2828.44	3					2832.65	1				
2828.58	3					2832.87	2 _h				
2828.65	5 _D	Fe II— Fe II	231 255	2828.622 2828.681	UV UV	2833.08	3 _h	Pb I Fe II	1 380	2833.060 2833.100	UV 23
2828.80	5	OH Fe I	(1-0) 45	2828.784 2828.808	8 UV	2833.31	3				
2828.98	2 _D	OH	(1-0)	2828.984	8	2833.40	5	Fe I	137	2833.401	UV
2829.28	4	OH	(1-0)	2829.277	8	2833.49	2				
2829.36	3	OH	(1-0)	2829.373	8	2833.84	5	OH	(1-0)	2833.843	8
2829.47	2	Fe I		2829.485	29	2833.94	2	Co I	2	2833.922	UV
2829.58	2					2834.02	2 _d	Ti I?— Fe I?	 176	2834.002 2834.050	58 43
2829.86	2	OH	(1-0)	2829.879	8	2834.17	5	OH— Fe I	(1-0) 93	2834.172 2834.173	8 7
2830.06	3 _d	Fe II OH	259 (1-0)	2830.061 2830.095	UV 8						
2830.25	2	Cr II	182	2830.24	UV						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2834.23	4	Cr II	195	2834.24	UV	2837.04	4				
2834.42	4	Fe I Fe I	92 90	2834.413 2834.419	7 7	2837.14	1	OH Co I	(1-0) 137	2837.134 2837.154	8 UV
2834.54	5	Ni I	2	2834.547	UV	2837.20	2	Fe I Zr I		2837.212 2837.23	43 UV
2834.62	2	OH	(1-0)	2834.630	8	2837.30	4	Fe II	231	2837.300	UV
2834.74	4	Fe I	159	2834.754	7	2837.73	1				
2834.87	1	Fe I	154	2834.886	43	2837.87	4	Al I Cr II	13 81	2837.856 2837.88	14 UV
2834.94	2	Co II?		2834.947	18	2837.96	2	Al I	13	2837.963	14
2835.00	1	Fe II?		2835.006	38	2838.12	6	Fe I	44	2838.119	7
2835.07	1					2838.24	4	Fe II	380	2838.235	UV
2835.14	1					2838.33	1				
2835.26	4	Cr I?	55	2835.242	UV	2838.45	4	Fe		2838.448	7
2835.38	4					2838.62	1h	Os I	12	2838.626	UV
2835.45	6	Fe I	2	2835.456	7	2838.79	3	Cr II	250	2838.78	UV
2835.53	5	OH	(1-0)	2835.530	8	2838.96	4	Ni I OH	68 (1-0)	2838.951 2838.984	UV 8
2835.63	6	Cr II	5	2835.63 ‡	UV	2839.00	4	Cr I	54	2839.013	UV
2835.72	6	Fe II	216	2835.716	UV	2839.22	4d	Cr II OH OH		2839.23 2839.234 2839.234	UV 8 8
2835.94	5	Fe I	93	2835.950	7	2839.32	1	Zr II	38	2839.34	UV
2836.04	1					2839.45	2h	OH	(1-0)	2839.450	8
2836.17	4w	Fe II	294	2836.185	UV	2839.51	3	Fe II	391	2839.535	UV
2836.31	5	Mn I Fe I OH	6 175 (1-0)	2836.310 2836.315 2836.320	UV UV 8	2839.63	1w				
2836.44	4	Fe I? ICr II		2836.41 2836.47	51 UV	2839.80	4	Fe II	380	2839.819	UV
2836.50	5	IFe II Vd II	294 61	2836.509 2836.527	UV UV	2840.02	5	Cr II	82	2840.01	UV
2836.72	2	C II- OH	13 (1-0)	2836.710 2836.736	37 8						
2836.82	1										

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2840.17	3	Al I	13	2840.205	14	2843.95	6D	Fe I	2	2843.920	7
								Fe I	44	2843.977	7
2840.35	5	Fe II	195	2840.342	UV	2844.31	1	OH	(1-0)	2844.304	8
2840.43	6	Fe I	2	2840.422	7	2844.44	1H	Mg II		2844.479	38
2840.66	5	II Fe II OH	217 (1-0)	2840.644 2840.681	UV 8	2844.58	3	OH	(1-0)	2844.581	8
2840.76	5	Fe II	280	2840.756	UV	2844.75	2	OH	(1-0)	2844.750	8
2840.89	3	Cr I	88	2840.891	UV	2844.85	1				
2840.94	4	Fe I	123	2840.937	7	2844.98	1h	Fe II	399	2844.973	UV
2841.03	3	Vd II	61	2841.039	UV	2845.25	2h	Vd II?	160	2845.241	UV
2841.16	2					2845.39	4	Fe II	294	2845.392	UV
2841.26	3	Fe I		2841.260	29	2845.60	6	Fe I	43	2845.594	7
2841.36	4	Fe II	196	2841.354	UV	2845.72	5	Fe I	58	2845.714	UV
2841.51	4	OH	(1-0)	2841.481	8	2845.82	3				
2841.94	6	Ti II	7	2841.914	UV	2845.92	3	Ti I		2845.938	58
2842.08	4	Fe II	196	2842.076	UV	2846.03	1	Cr I	99	2846.024	UV
2842.33	4	Si I	82	2842.334	37	2846.30	1	Cr II	296	2846.32	UV
2842.41	3					2846.41	2h				
2842.66	4D	OH Fe II	(1-0) 279	2842.635 2842.677	8 UV	2846.46	4	Cr II OH	250 (1-0)	2846.44 2846.461	UV 8
2842.76	3	Cr II	250	2842.78	UV	2846.72	6	Mg I	5	2846.716	44
2842.90	4					2846.83	5	Fe I	87	2846.830	UV
2843.06	1					2846.98	3	Mg II		2846.952	38
2843.25	7W	ICr II OH Fe II	5 (1-0) 231	2843.24 2843.294 2843.323	UV 8 UV	2847.22	4	Fe II	187	2847.208	UV
2843.48	4	Fe II	294	2843.485	UV	2847.36	2h				
2843.63	5	Fe I	43	2843.631	7	2847.46	2				
2843.79	5					2847.57	3D				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2847.77	4	OH Fe II	(1-0) 380	2847.771 2847.791	8 UV	2855.44	2	OH Fe I	(1-0) 136	2855.450 2855.450	8 43
2847.94	3					2855.67	6	Cr II Fe II	5 196	2855.67 2855.676	UV UV
2848.07	5D	Fe II— Fe II	196 399	2848.046 2848.106	UV 7	2855.86	3	OH?	(1-0)	2855.859	8
2848.21	2	Mo II	4	2848.238	UV	2856.04	1				
2848.35	6W	Fe II IMg I	391 5	2848.332 2848.342	UV 44	2856.14	5	Fe II	195	2856.144	UV
2848.53	2	Zr I	6	2848.50	UV	2856.33	3	Cr II	81	2856.32	UV
2848.72	6	Fe I	43	2848.714	7	2856.38	4	Fe II	380	2856.392	UV
2848.92	3	Fe II	317	2848.899	UV	2856.56	1	OH?	(1-0)	2856.559	8
2849.06	2	Vd II	61	2849.055	UV	2856.61	2	Ti II	20	2856.616	UV
2849.36	3W	Cr II	81	2849.33	27	2856.76	5	Cr II	11	2856.77	UV
2849.60	5	Fe II	196	2849.601	UV	2856.91	3	Fe II	399	2856.928	UV
2849.84	7	Cr II	5	2849.83	UV	2857.00	1	Fe I?		2856.99	51
2851.08	1	Ti II	16	2851.087	UV	2857.18	4	Fe II Fe I	294 123	2857.171 2857.20	UV UV
2851.35	4	Cr II	82	2851.35	UV	2857.40	5	Cr II Fe II	11 195	2857.40 2857.415	UV UV
2851.64	6	Mg I	5	2851.660	44	2857.49	1				
2851.79	6	Fe I	44	2851.797	7	2857.61	2				
2852.13		Mg I	1	2852.127±	44	2857.80	4	Ti II Fe I		2857.801 2857.810	56 7
2853.52	2					2857.98	4	OH Fe I	(1-0)	2857.974 2857.996	8 29
2853.67	2	Fe I	88	2853.684	7	2858.08	3				
2853.75	4	Fe I	159	2853.772	7	2858.18	1				
2853.92	4	ITi II Cr I	7 54	2853.922 2853.94	UV UV	2858.33	5	Fe II Fe II	195 279	2858.340 2858.340	UV UV
2855.07	3	Cr II	214	2855.05	UV	2858.40	4	Ti II	6	2858.399	UV
2855.28	2w	Vd I— Vd II	6 83	2855.252 2855.298	UV UV	2858.52	2	Fe II	354	2858.519	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2858.65	5	Fe II Cr II	399 11	2858.639 2858.64	UV UV	2863.44	5	Fe I	87	2863.429	UV
2858.91	6	Fe I Cr II	2 5	2858.896 2858.91	7 UV	2863.55	2	OH?	(1-0)	2863.536	8
2859.45	3	Fe I?		2859.48	51	2863.71	4	Ni II OH	26 (1-0)	2863.699 2863.720	52 8
2859.58	1					2863.87	6	Fe I	2	2863.864	7
2859.65	2	Co I	52	2859.654	UV	2864.12	2	Fe II	380	2864.134	UV
2859.78	2	OH	(1-0)	2859.777	8	2864.29	1				
2859.98	1	Vd I	6	2859.997	UV	2864.37	3	Fe II Vd I	195 6	2864.367 2864.386	UV UV
2860.20	3	Fe I		2860.206	29	2864.51	1	Vd II?	158	2864.517	UV
2860.41	2h					2864.63	1w				
2860.61	3	OH	(1-0)	2860.615	8	2864.98	3	Fe II	294	2864.968	UV
2860.94	5	Cr II	5	2860.92	UV	2865.03	2				
2861.17	4	Fe II	61	2861.187	23	2865.11	6	Cr II	5	2865.10	UV
2861.31	3	Ti II~	16	2861.291	UV	2865.34	4	Cr II	11	2865.34	UV
2861.68	1	Hf II	10	2861.695	5	2865.45	3	Fe II	391	2865.473	UV
2861.89	2	Fe II	280	2861.903	UV	2865.50	4	Ni I	26	2865.498	UV
2861.99	3	Ti II Fe I		2861.984 2861.996	56 29	2865.61	1	Zr II	10	2865.61	UV
2862.03	3	OH	(1-0)	2862.035	8	2865.67	2	OH	(1-0)	2865.668	8
2862.32	4	Ti II	16	2862.34	UV	2865.88	3	Cr II	265	2865.87	UV
2862.49	6	Fe I	43	2862.494	7	2866.15	1	Fe I		2866.150	43
2862.57	6	Cr II	5	2862.57	UV	2866.23	3	OH	(1-0)	2866.237	8
2862.73	2					2866.38	3h	Fe I	168	2866.385	29
2862.91	1h					2866.63	5	Fe I	43	2866.625	7
2863.07	3h					2866.74	6	Cr II	5	2866.72	UV
2863.30	1	Sn I	1	2863.324	UV	2867.09	5	Cr II	11	2867.09	UV
						2867.31	4	Fe I	93	2867.309	7

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2867.37	1					2870.43	5	Cr II	11	2870.43	UV
2867.57	5	Fe I	90	2867.561	7	2870.56	1	Vd I	6	2870.575	UV
2867.64	6	Cr II	5	2867.65	UV	2870.60	3	Fe II	195	2870.608	UV
2867.88	3	Fe I	91	2867.879	7	2870.77	1				
2867.93	1					2871.06	4	Fe II	195	2871.059	UV
2868.04	2	Fe II	256	2868.046	UV	2871.12	4	Fe II	230	2871.125	UV
2868.15	2					2871.21	1	Co II		2871.221	18
2868.21	4	Fe I	142	2868.214	7	2871.31	1	Fe I	174	2871.31	UV
2868.45	4	Fe II	353	2868.446	UV	2871.44	2	Cr II	295	2871.45	UV
		Fe I	135	2868.453	7	2871.50	2	Mo II	4	2871.506	UV
		Fe I	174	2868.453	7	2871.62	3	Cr I	12	2871.628	UV
2868.58	2	OH	(1-0)	2868.581	8	2871.72	3	Fe I	149	2871.73	UV
2868.74	4	!Ti II	5	2868.732	UV	2871.98	3	OH	(1-0)	2871.987	8
		Ni I	76	2868.739	UV	2872.35	6w	OH	(1-0)	2872.324	8
2868.87	5	Fe II	61	2868.874	UV			!Fe I	43	2872.334	7
2868.97	2	Fe II?		2869.001	10			!Fe II	230	2872.382	UV
2869.04	2					2872.50	3	Co I	107	2872.497	UV
2869.15	3	Fe II	257	2869.156	UV			Fe I	177	2872.499	7
2869.23	3	Fe		2869.230	7	2872.58	2	Mn I	5	2872.583	UV
2869.30	6	Fe I	2	2869.308	7	2872.67	1h				
2869.39	3					2872.79	1				
2869.68	3w	Fe II	257	2869.694	UV	2872.92	2	Mn II		2872.935	19
2869.82	4	Fe I	142	2869.826	7	2872.98	1				
2869.91	3	OH	(1-0)	2869.913	8	2873.17	2	Cr I	60	2873.181	UV
2869.96	3	Vd II	12	2869.957	UV	2873.40	4	Fe II	279	2873.399	UV
2870.09	3	Mn II		2870.085	19	2873.46	5	!Cr II	5	2873.46	UV
2870.16	1	Cr I	55	2870.175	UV			Cr II	295	2873.46	UV
						2873.59	3				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2873.65	3	Fe I	158	2873.653	7	2877.29	5	Fe I	86	2877.301	7
2873.81	4	Cr II	11	2873.81	UV	2877.42	5	Ti II	14	2877.418	UV
2874.06	2w	Fe I Ti II	168 14	2874.028 2874.08	43 UV	2877.52	1	OH	(2--1)	2877.502	8
2874.17	6	Fe I	2	2874.172	7	2877.68	2	Vd II	82	2877.689	UV
2874.24	3	Ga I	1	2874.235	21	2877.97	6	Cr II	5	2877.97	UV
2874.32	3					2878.44	5	Cr II	5	2878.45	UV
2874.44	2d					2878.63	4				
2874.61	2					2878.67	4	Fe I	142	2878.669	43
2874.85	5	Fe I	142	2874.881	7	2878.73	4	OH Fe I	(1-0)	2878.733 2878.762	8 29
2875.00	3	Ru I Cr II	1 265	2874.984 2875.03	UV UV	2878.88	3	OH	(1-0)	2878.885	8
2875.07	1h					2878.95	4	Fe I Ni I	90 76	2878.952 2878.998	7 UV
2875.30	6D	Fe I Fe II	86 258	2875.302 2875.342	7 UV	2879.10	3	OH-	(2-1)	2879.093	8
2875.50	2	OH	(1-0)	2875.513	8	2879.15	5	Vd II	12	2879.158	UV
2875.66	3	Vd II	12	2875.687	UV	2879.26	5	Fe II Cr I	278 12	2879.241 2879.27	UV UV
2875.82	1	Ti II?		2875.8	UV	2879.46	5	Fe I Mn II	136 61	2879.457 2879.482	7 19
2875.98	5	II Cr II Zr I	11 4	2875.97 2875.98	UV UV	2879.54	2	Fe II	230	2879.543	UV
2876.07	3	Ni I	25	2876.090	UV	2879.61	1	Co I		2879.612	50
2876.25	6	Cr II	5	2876.24	UV	2879.72	3	Fe I		2879.741	29
2876.31	4	Cr II	288	2876.30	UV	2879.83	3	Mn II Fe II	69 293	2879.847 2879.849	19 UV
2876.53	4	OH	(1-0)	2876.564	8	2880.03	6	Vd II	12	2880.026	UV
2876.65	1	Cr II	263	2876.66	UV	2880.31	2	Ti II	20	2880.28	UV
2876.70	3	Fe I		2876.725	29	2880.59	5	II Fe I Cr I	43 13	2880.579 2880.62	7 UV
2876.79	4	Fe II	257	2876.804	UV						
2876.92	2					2880.75	6	Fe II	61	2880.750	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2880.85	6	Fe II Cr II	258 11	2880.828 2880.86	UV UV	2885.92	4	OH OH— Fe II	(1-0) (1-0) 317	2885.911 2885.911 2885.929	8 8 UV
2881.12	3	Mn II Cr I	60 60	2881.122 2881.14	19 UV	2886.03	3	Ti I?		2886.036	58
2881.58	8W	Si I	43	2881.579	37	2886.24	4	Fe II	229	2886.234	UV
2882.50	6	Vd II	12	2882.493	UV	2886.31	5	Fe I	87	2886.316	UV
2882.63	3	Fe I		2882.634	29	2886.44	4	Co I	1	2886.444	UV
2882.84	4d	OH OH	(1-0) (2-1)	2882.833 2882.871	8 8	2886.67	4	Mn II	60	2886.671	19
2883.10	1h					2886.99	5	Cr I	12	2886.995	UV
2883.46	2h	Au I	6	2883.45	UV	2887.14	4	Fe I?		2887.154	51
2883.65	4					2887.34	5D	Fe II Fe I	257 150	2887.312 2887.358	UV 7
2883.72	6w	OH Fe II Fe I	(1-0) 230 167	2883.686 2883.709 2883.748	8 UV UV	2887.45	3	Ti II	14	2887.456	UV
2883.94	1	OH	(2-1)	2883.935	8	2887.58	2				
2884.10	5	Ti II	14	2884.099	UV	2887.82	6	Fe I	167	2887.805	7
2884.14	1	Mn II	60	2884.162	19	2887.86	4	—Mn II	61	2887.888	19
2884.27	1	Fe II	442	2884.282	23	2887.97	5	Fe I OH	149 (2-1)	2887.956 2887.977	7 8
2884.39	1h					2888.03	4				
2884.65	2	OH	(2-1)	2884.671	8	2888.10	5	Fe II	215	2888.089	UV
2884.78	5	Vd II Vd II	12 82	2884.776 2884.776	UV UV	2888.24	3	Vd II	82	2888.244	UV
2884.84	1	OH	(2-1)	2884.845	8	2888.38	2	Cr I	13	2888.38	UV
2885.14	2	Mn II	69	2885.131	19	2888.50	3				
2885.35	4	Fe I?		2885.344	51	2888.64	1	Ti II		2888.62	UV
2885.51	2					2888.73	3	Cr II Fe II	238 317	2888.73 2888.736	UV UV
2885.55	1w					2888.94	5	Ti II	5	2888.923	UV
2885.81	2	OH	(2-1)	2885.811	8	2889.00	3	Fe II— OH	229 (2-1)	2888.988 2889.021	UV 8

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2889.20	6	Cr II Cr I	11	2889.19 2889.219	UV 28	2891.67 2891.72	6	Vd II	12	2891.636	UV
2889.28	5	Cr I	12	2889.294	28		3	Fe I Fe I	158 183	2891.688 2891.707	7 7
2889.53	5d	Cr II IMn II	207 60	2889.50 2889.520	UV 19	2891.86	3	Cr II	291	2891.87	UV
2889.62	6	Mn II IVd II	60 12	2889.600 2889.614	19 UV	2891.90	4	Fe I		2891.905	7
2889.81	4	Cr II	160	2889.82	UV	2892.07	1				
2889.89	6	Fe I Fe I	168 149	2889.864 2889.901	7 7	2892.23	3	Fe II Co I	308	2892.215 2892.242	UV 50
2890.00	5	Fe I	142	2889.989	7	2892.44	6D	Mn II Vd II Fe I	61 12 142	2892.389 2892.434 2892.478	19 UV 7
2890.15	2	OH? Cr I	(2-1) 74	2890.142 2890.16	8 UV	2892.66	6	Vd II	12	2892.650	UV
2890.35	1	Cr I?	13	2890.35	UV	2892.72	2	Fe I?	136	2892.687	43
2890.42	3	Fe I Co II?		2890.414 2890.428	29 18	2892.82	5	Fe II	61	2892.822	UV
2890.46	2	OH	(2-1)	2890.474	8	2892.94	2	Cr II	160	2892.95	UV
2890.57	3	OH	(1-0)	2890.560	8	2893.17	1	OH- OH	(2-1) (2-1)	2893.155 2893.194	8 8
2890.67	2	Fe II?		2890.687	10	2893.28	6D	Cr I- Vd II	12 12	2893.254 2893.314	UV UV
2890.75	1	Cr I	74	2890.738	UV	2893.46	4D	OH Fe I? OH OH	(2-1) (1-0) (1-0)	2893.423 2893.43 2893.492 2893.492	8 51 8 8
2890.86	5	Fe I	184	2890.856	7	2893.76	3	Fe I	43	2893.763	7
2891.06	6	Cr II ITi II	240 5	2891.06 2891.066	UV 56	2893.88	4	Fe I	88	2893.881	7
2891.20	3	Cr II	238	2891.20	UV	2894.07	2	Fe II	293	2894.058	UV
2891.28	3	OH	(1-0)	2891.292	8	2894.18	3	Cr I	12	2894.168	UV
2891.35	3	Mn II	69	2891.332	19	2894.26	2	Cr II	288	2894.24	UV
2891.39	4	Cr II IFe I Cr I	194 89 60	2891.40 2891.404 2891.42	UV 7 UV	2894.30	1	OH	(2-1)	2894.303	8

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2894.42	2D	Cr II— Mo II	160 4	2894.40 2894.446	UV UV	2897.75	4	Cr II Fe II	159 323	2897.73 2897.744	UV UV
2894.50	5	Fe I	134	2894.504	7	2897.91	1W	Pt I	6	2897.89	UV
2894.63	1	Mn I	20	2894.625	UV	2898.10	3	OH	(2-1)	2898.117	8
2894.79	4	II Fe II Cr II	230 160	2894.776 2894.81	UV 27	2898.22	2	OH	(2-1)	2898.212	8
2894.90	2	Mn II	61	2894.901	19	2898.35	5	Fe I		2898.351	7
2895.05	6d	Cr II I Fe I Fe II	160 87 257	2895.02 2895.035 2895.071	UV UV UV	2898.53	4	Cr II	95	2898.53	UV
2895.22	4	Fe II	294	2895.215	UV	2898.70	4	OH Mn II	(1-0) 61	2898.694 2898.702	8 19
2895.28	2					2898.86	4	Fe I		2898.857	7
2895.66	1	Cr I	74	2895.675	UV	2899.15	2	Cr II	240	2899.15	UV
2895.78	2	Ti II	1	2895.776	58	2899.21	3	ICr I Vd I	12 5	2899.203 2899.207	UV UV
2895.98	2H	—OH	(2-1)	2895.986	8	2899.24	2	Nb II	14	2899.230	UV
2896.05	1	Cr I	74	2896.064	UV	2899.42	6	OH I Fe I	(1-0)	2899.399 2899.415	8 7
2896.21	5	Vd II	11	2896.198	UV	2899.46	4	Cr II	159	2899.48	UV
2896.31	3	Cr II	159	2896.31	UV	2899.59	1	Vd I	5	2899.602	UV
2896.46	3	Cr II Cr II	159 288	2896.45 2896.45	UV UV	2899.69	2	Cr I	87	2899.68	UV
2896.59	3w	OH Fe I	(2-1)	2896.575 2896.595	8 29	2899.81	1	Co I	136	2899.819	UV
2896.75	4	Cr II Cr I	97 12	2896.74 2896.756	UV UV	2899.92	1				
2897.05	4	Mn II	50	2897.068	19	2900.16	4	Mn II	69	2900.154	19
2897.26	4	Fe II	254	2897.264	UV	2900.22	4	OH Cr I	(2-1) 13	2900.225 2900.25	8 UV
2897.44	1					2900.45	3				
2897.67	4w	Fe I Cr II	142 212	2897.637 2897.67	7 UV	2900.54	2	Mn I	20	2900.545	UV
						2900.88	1				
						2900.95	4	OH	(2-1)	2900.958	8

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2901.00	4	Cr II	97	2901.00	UV	2904.29	3	OH	(2-1)	2904.298	8
2901.10	1					2904.46	1	Fe I	182	2904.478	43
2901.38	5	Fe I	89	2901.380	7	2904.52	3	Fe I		2904.522	29
{ 2901.51	4	OH	(1-0)	2901.522	8	2904.67	2	Cr I	87	2904.674	UV
		OH	(1-0)	2901.522	8	2904.75	1	Gd III		2904.726	3
{ 2901.57	3	Fe I		2901.587	43	2904.99	2				
2901.80	4	Fe I	91	2901.811	43	2905.20	3 _w	Fe II— Zr II	255 37	2905.185 2905.22	UV UV
2901.91	5	Fe I	142	2901.910	UV	2905.37	4	Fe I		2905.376	51
2901.96	4	Ti II	1	2901.94	47	2905.49	4	Cr I	12	2905.477	UV
		Fe I	149	2901.976	43	2905.57	3	Fe I	182	2905.57	UV
2902.04	2	Fe II	293	2902.056	UV	2905.66	1	Ti I? —Si II	17	2905.655 2905.692	58 37
2902.18	2	Mn I	5	2902.203	UV	2905.75	3	Ni I	74	2905.746	UV
2902.30	3	Fe II	257	2902.317	UV	2905.91	2	Fe II	435	2905.770	UV
		Cr I	13	2902.44	UV			Vd I	5	2906.120	UV
2902.46	4	Fe II	278	2902.459	UV	2906.12	4			2906.134	UV
2902.61	3					2906.20	1	Cr II	227	2906.17	UV
2902.66	2					2906.45	6	Vd II	11	2906.448	UV
2902.90	2H	Mn II	50	2902.901	19	2906.60	4	Fe I?		2906.62	51
2903.08	5	Mg I	4	2902.923	44	2906.73	3	Fe I	150	2906.741	29
		Vd II	11	2903.068	UV	2907.11	1				
2903.20	2	Co I	130	2903.197	UV	2907.23	3d	Mn I OH	20 (1-0)	2907.214 2907.250	UV 8
{ 2903.65	1	Ni I?		2903.653	UV	2907.48	6D	Vd II	10	2907.457	UV
		Vd I	4	2903.700	UV	2907.85	4	Ni I	2	2907.457	UV
2903.77	2							Fe I	167	2907.517	7
2903.95	3	Cr II	97	2903.97	UV			Fe II	60	2907.853	UV
2904.08	3	Fe I	167	2904.087	7						
2904.16	5	Fe I		2904.160	7						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2907.94	3	OH	(2-1)	2907.950	8	2911.58	3	Fe II		2911.579	10
2908.00	3	Mn I OH	5 (1-0)	2907.993 2908.028	UV 8	2911.67	4	Cr II	212	2911.69	UV
2908.19	4					2911.90	2	Mo II	4	2911.915	UV
2908.28	3	Cr II	97	2908.29	UV	2912.07	3	Ti I	23	2912.082	58
2908.42	2h	Vd II	154	2908.44	UV	2912.15	7W	Fe I	1	2912.157	7
2908.48		OH	(2-1)	2908.496	8	2912.26	4	Fe I	86	2912.257	7
2908.71	1	Fe I?		2908.700	43	2912.50	1h				
2908.81	6W	Vd II	12	2908.810	UV	2913.07	4	Ti II	1	2913.08	UV
2909.04	4	Cr I	12	2909.049	UV	2913.20	2	Mg I		2913.205	38
2909.10	3	-Mo II	4	2909.108	UV	2913.44	2				
2909.31	3	Fe I	149	2909.316	7	2913.58	4	Ni II	26	2913.590	52
2909.49	4	Fe I		2909.499	7	2913.71	4w	-Cr I Cr I	87 87	2913.716 2913.716	UV UV
2909.87	4					2913.99	4	Ni I	1	2914.006	UV
2909.91	4	Ti II	1	2909.912	UV	2914.19	4	Fe I	132	2914.197	7
2910.01	5	OH II Vd II	(1-0) 11	2910.002 2910.007	8 UV	2914.29	4	Fe I	89	2914.304	7
2910.09	3	OH	(1-0)	2910.094	8	2914.50	3				
2910.23	1					2914.58	5	Mn I	10	2914.599	UV
2910.38	5	Vd II	11	2910.380	UV	2914.73	2				
2910.64	4	Cr II	211	2910.64	UV	2914.85	2	Au I	6	2914.84	UV
2910.74	3	Fe II Fe II	435 278	2910.724 2910.761	UV UV	2914.91	2	Vd I	5	2914.924	UV
2910.90	5	Cr I Fe I	12 168	2910.892 2910.926	UV 7	2915.22	3h	Cr II	227	2915.22	UV
2911.06	5	Vd II	10	2911.050	UV	2915.45	6W	Mg I	15	2915.453	44
2911.12	4	Cr I	12	2911.148	UV	2915.63	3h	Fe I		2915.658	29
2911.22	2					2915.79	2				
						2915.98	3	Zr II	9	2915.98	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2916.14	5	Fe II Cr I	60 13	2916.150 2916.16	UV UV	2919.84	4	Fe I	142	2919.840	7
2916.20	5	-OH?	(1-0)	2916.237	8	2919.99	5	Vd II	11	2919.989	UV
2916.52	3	Fe I	117	2916.522	43	2920.13	3d				
2916.62	2	Zr II	9	2916.63	UV	2920.30	3	Fe I	136	2920.29	UV
2916.82	2					2920.37	5	Vd II Vd II	10 11	2920.377 2920.377	UV UV
2916.91	3	OH Fe II	(2-1) 229	2916.922 2916.933	8 UV	2920.62	3	Fe I		2920.616	43
2917.08	3	Fe II	336	2917.087	UV	2920.68	5	Fe I	87	2920.690	7
2917.19	2	OH	(1-0)	2917.185	8	2920.98	5	Fe?		2920.981	7
2917.36	4	Vd II	11	2917.365	UV	2921.15	3				
2917.47	5	Fe II	61	2917.465	UV	2921.22	4	Cr II	286	2921.23	UV
2917.64	3h					2921.35	1	Cr I?	98	2921.35	UV
2917.87	4	Fe II?		2917.876	10	2921.59	3	Fe I	121	2921.600	43
2918.02	5	Fe I	182	2918.023	UV	2921.72	4	Fe I		2921.708	43
2918.16	4					2921.78	5	Cr II	95	2921.81	UV
2918.25	2	Cr I	13	2918.24	UV	2922.02	4	Fe II	293	2922.023	UV
2918.34	4	Fe I	134	2918.352	7	2922.15	3	OH	(2-1)	2922.104	8
2918.56	1	Fe II Fe I	435	2918.541 2918.563	UV 43	2922.21	4	Fe?		2922.211	7
2918.65	3	Ce II		2918.663	6	2922.38	4	Fe I	86	2922.383	UV
2918.80	4	OH Fe I	(2-1)	2918.789 2918.816	8 7	2922.53	1				
2918.90	3	OH	(1-0)	2918.919	8	2922.62	4	Fe I	122	2922.623	7
2919.01	4	Fe I?		2919.039	51	2922.82	1				
2919.19	5	OH?- OH?	(2-1) (1-0)	2919.168 2919.209	8 8	2923.06	1				
2919.57	2W	Co I- Hf II	134 8	2919.552 2919.60	UV 5	2923.16	4	Fe?		2923.164	7
						2923.30	5	Fe I	182	2923.286	7
						2923.42	5D	Fe I Cr II		2923.430 2923.46	7 UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2923.62	3	Vd I	5	2923.627	UV	2926.98	2	Zr II	61	2926.99	UV
2923.67	3	Cr II	286	2923.67	UV	2927.08	3	Cr II	256	2927.09	UV
2923.84	5	Fe I	166	2923.853	7	2927.23	1 _h	Mn II	50	2927.230	19
2924.01	6 _D	Fe I II Vd II	166 10	2924.002 2924.017	29 UV	2927.40	2	Mn II	50	2927.395	19
2924.34	4	Fe I		2924.344	43	2927.57	4	Fe I		2927.55	UV
2924.48	3	Fe I	86	2924.483	43	2927.65	1	Co I	136	2927.667	UV
2924.54	2					2927.81	1	Nb II	15	2927.804	UV
2924.64	6	Vd II	10	2924.633	UV	2927.88	3	Fe I OH	(2-1)	2927.884 2927.887	51 8
2924.80	3	Ir I	1	2924.792	UV	2928.10	5	Cr II	55	2928.12	UV
2924.94	1	Fe I?	183	2924.910	43	2928.19	3				
2925.08	4 _h	OH?—	(2-1)	2925.062	8	2928.29	4	OH Ti I Cr II Cr II	(1-0) 34 95 256	2928.288 2928.313 2928.32 2928.32	8 58 UV UV
2925.30	2	Vd II	81	2925.288	UV						
2925.35	4	Fe I	167	2925.358	7						
2925.52	4					2928.62	6	Mg II	2	2928.634	46
2925.60	4 _w	Mn I	10	2925.58	UV	2928.76	4	Fe I	131	2928.751	7
2925.70	3	Fe I		2925.715	43	2929.02	6 _w	Fe I	1	2929.007	7
2925.78	4	Fe		2925.785	7	2929.12	5	Fe I	182	2929.109	7
2925.89	4	Fe I	89	2925.900	7	2929.23	4	Fe		2929.239	7
2926.01	3	Fe I		2926.014	43	2929.28	3				
2926.15	3	Cr II	95	2926.15	UV	2929.43	3	Cr II	239	2929.44	UV
2926.24	3	Vd I	4	2926.258	UV	2929.49	3	Co I?	129	2929.505	UV
2926.44	3	Vd II?	177	2926.442	UV	2929.61	4	Fe I	87	2929.618	UV
2926.60	6 _W	Fe II	60	2926.584	UV	2929.78	2	Pt I	1	2929.79	UV
2926.76	3	Ti II	27	2926.75	UV	2930.11	2	Vd II	81	2930.132	UV
2926.90	3	OH OH	(1-0) (2-1)	2926.894 2926.894	8 8	2930.22	1	Mn I	3	2930.245	UV
						2930.38	2	Fe I		2930.395	29

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2930.52	1	Fe II?		2930.489	10	2934.39	5	Fe I Vd II	117 10	2934.371 2934.394	7 UV
2930.64	3					2934.49	3	Fe II	278	2934.488	UV
2930.81	5	Vd II Cr II	10 55	2930.798 2930.83	UV UV	2934.60	3	Fe I Zr II		2934.598 2934.62	29 UV
2930.90	3	Ni I	78	2930.908	UV	2934.72	2	Mn II	50	2934.723	19
2931.00	2					2934.93	1				
2931.10	2					2935.13	4	Cr II	55	2935.12	UV
2931.26	1	Ti II	30	2931.261	56	2935.23	2				
2931.43	4 _w	Fe I OH	148 (2-1)	2931.412 2931.440	7 8	2935.33	1	Mn II	50	2935.355	19
2931.62	3	Fe I	117	2931.622	43	2935.54	2	Cr I? OH	(1-0)	2935.534 2935.548	28 8
2931.80	4	Fe I	166	2931.805	7	2935.65	2	Mn I	18	2935.643	4
2931.85	2	Sr I	1	2931.830	UV	2935.86	2	Vd I	3	2935.880	UV
2931.98	3					2936.06	6 _D	Fe II- Fe I	323 89	2936.022 2936.116	UV 7
2932.32	2 _h	Vd II?	166	2932.323	UV	2936.33	3	Zr II	11	2936.31	UV
2932.54	1	Ti I		2932.522	58	2936.51	7 _W	Mg II	2	2936.509	46
2932.60	2	Ni I		2932.618	48	2936.74	5	Mg I	3	2936.739	44
2932.69	3	Cr II	95	2932.69	UV	2936.91	8 _W	Fe I	1	2936.903	7
2932.87	2 _h					2937.18	2	OH?	(1-0)	2937.199	8
2933.04	6 _w	Mn II	5	2933.054	19	2937.29	3	Ti I	1	2937.293	58
2933.53	4	Ti I	1	2933.526	UV	2937.46	3				
2933.81	4	Mn II- Vd II	50 81	2933.779 2933.833	19 UV	2937.56	1				
2933.96	4	Cr II	95	2933.95	UV	2937.81	5	Hf II II Fe I	7 122	2937.782 2937.807	5 7
2934.00	2	Mn I	17	2934.020	4	2937.92	1	Mn I		2937.916	UV
2934.13	1	OH	(2-1)	2934.135	8	2938.04	3	Cr I?	73	2938.03	UV
2934.33	3	Cr II	211	2934.30	UV						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2938.12	1	OH	(1-0)	2938.128	8	2941.99	5w	Cr II	294	2941.96	UV
2938.24	1	Vd II	81	2938.259	UV			!Ti I	1	2941.963	58
2938.31	2	OH	(2-1)	2938.327	8			Ti II	26	2941.993	UV
2938.47	5	Mg I	3	2938.473	44	2942.18	3	!Mg I	3	2941.995	44
2938.72	3	Ti II	26	2938.69	UV	2942.37	2	Fe II		2942.186	10
		Fe I	117	2938.722	43			Vd I	1	2942.354	UV
2939.08	5	Fe I	118	2939.071	7			Vd I	3	2942.354	UV
		Fe I	182	2939.071	7	2942.62	4	Fe I		2942.630	51
2939.30	7w	Mn II	5	2939.312	19	2942.73	2	Ni II	25	2942.71	UV
2939.50	5	Fe II	60	2939.506	UV	2942.99	4				
2939.90	3	Mn I	17	2939.904	4	2943.13	4	Ti II	30	2943.12	UV
2940.09	1	Fe II?	441	2940.114	7			Mn II	82	2943.139	19
2940.23	2	Cr II	294	2940.22	UV	2943.19	2	Vd I	1	2943.197	UV
2940.34	4	Mn I	10	2940.331	UV	2943.30	3	Fe I		2943.304	43
2940.47	3	Fe II		2940.467	10	2943.57	4	Fe?		2943.574	7
2940.54	2					2943.64	4	Ga I	1	2943.636	21
2940.59	5	Fe I	173	2940.589	7	2943.91	6	Ni I	24	2943.912	UV
2940.90	2	Fe II?		2940.889	23	2944.18	1	Ga I	1	2944.173	21
		OH	(2-1)	2940.907	8	2944.40	6w	Fe II	78	2944.399	UV
2941.02	4h	Mn I	17	2941.038	4	2944.56	6	Vd II	10	2944.568	UV
2941.26	5h	Fe I		2941.233	43	2945.06	5	Fe I		2945.052	7
2941.37	6d	Fe I	1	2941.343	UV	2945.25	5	Fe II	60	2945.262	UV
		Vd II	10	2941.372	UV	2945.45	3	Ti II	26	2945.47	UV
2941.49	5	Vd II	10	2941.485	UV	2945.68	4	Fe I		2945.702	29
2941.73	3					2945.86	3	Fe I		2945.870	29
								Fe II		2945.884	10
2941.86	2	Cr I	5	2941.874	UV	2946.08	2	Fe I		2946.095	29
						2946.53	1	Vd I	1	2946.54	UV
						2946.65	1				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2946.72	2					2951.16	3	Mn II	82	2951.168	19
2946.83	4	Cr II	192	2946.81	UV	2951.35	4	Fe I		2951.356	29
2946.96	1	W I	5	2946.989	UV	2951.55	3	Fe I?		2951.56	51
2947.11	4	Fe I	182	2947.116	29	2951.75	1				
2947.26	3	Fe I	86	2947.251	43	2951.88	1				
2947.36	5	Fe I	131	2947.363	UV	2951.97	1	Cr II	177	2951.94	UV
2947.45	3	Ni II?	35	2947.454	52	2952.07	5	Vd II	10	2952.07	UV
2947.66	6w	Fe II	78	2947.658	UV	2952.24	3w	Zr II—	1	2952.23	UV
2947.89	8W	Fe I	1	2947.876	7	2952.43	1				
2948.10	3	Vd II	196	2948.076	UV	2952.56	1	Fe I		2952.57	51
2948.24	5	Ti I	1	2948.238	58	2952.64	1				
2948.44	5	Fe I	166	2948.433	UV	2952.87	1w	Mn II	49	2952.871	19
2948.73	4	Fe I	118	2948.727	7	2953.06	1				
2948.97	5	Fe I	117	2948.952	7	2953.36	3	Cr II	55	2953.34	UV
2949.21	8w	Fe II Mn II	277 5	2949.178 2949.204	UV 19	2953.51	5	Fe I	166	2953.486	UV
2949.45	3	Cr II	178	2949.44	UV	2953.69	4	Cr II	192	2953.70	UV
2949.68	4	Fe I	117	2949.688	29	2953.77	6	Fe II	60	2953.774	UV
2949.79	2	Cr II?	210	2949.79	UV	2953.93	8W	Fe I	1	2953.940	UV
2950.13	1	Cr II Cr II	65 178	2950.10 2950.10	UV UV	2954.33	3	Vd I	1	2954.33	UV
2950.25	5w	Fe I	120	2950.243	7	2954.56	2	Ti I		2954.561	58
2950.33	5	Vd II	10	2950.344	UV	2954.65	5	Fe I	132	2954.652	7
2950.69	1	Cr II?	65	2950.69	UV	2954.81	1				
2950.83	1					2954.95	4	Fe I		2954.957	29
2950.88	3	Nb II	14	2950.876	UV	2955.14	4	Cr II Mn II	177 49	2955.12 2955.141	UV 19
2951.10	3	Fe II	214	2951.095	UV	2955.39	1	Mn II Co I	49	2955.379 2955.382	19 UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2955.50	1	Gd III		2955.534	3	2958.94	2	Mn II	49	2958.942	19
2955.62	3	Fe I		2955.619	29			Mn II	49	2958.942	19
2955.68	1					2959.00	1	Ti II?	34	2958.996	56
2955.79	4	Zr II Fe I	61	2955.77 2955.777	UV 43	2959.24	1	OH	(1-0)	2959.246	8
2955.93	3	Ce II?		2955.941	6	2959.31	5	Fe I		2959.329	7
2956.13	5	Ti I	1	2956.118	58	2959.59	5	Fe II	254	2959.601	UV
2956.33	4	Cr I	5	2956.328	UV	2959.67	5	Fe I	172	2959.683	7
2956.60	4	Cr II-	176	2956.60	UV	2959.82	2	Fe II Fe II	403 439	2959.841 2959.841	23 UV
2956.70	5	Fe I	118	2956.704	7	2959.94	6	Cr II	177	2959.95	UV
2956.79	4	Ti I	1	2956.795	58	2959.99		Fe I	[316]	2959.991	7
2956.84	4	Fe I	165	2956.858	7	2960.07	1				
2956.98	2	Mn II	49	2956.977	19	2960.29	5	Fe I	134	2960.296	7
2957.22	2					2960.49	3				
2957.36	7W	Fe I	1	2957.364	7	2960.54	5	Fe I		2960.554	7
2957.49	6	Fe I Vd II	132 10	2957.486 2957.520	7 UV	2960.66	4	Fe I	178	2960.660	7
2957.63	4					2960.76	3				
2957.86	1	Fe I?		2957.868	43	2961.08	3				
2958.06	1w					2961.17	3	Cu I	15	2961.165	UV
2958.18	1					2961.28	5	Fe II	60	2961.272	UV
2958.28	3	Ni I	74	2958.283	UV	2961.36	3	Fe I		2961.346	43
2958.41	3					2961.45	3	Ti I	28	2961.442	58
2958.52	1	Fe II	398	2958.528	UV	2961.56	2				
2958.69	2	Mn II	50	2958.715	19	2961.72	4	Mn II Cr II Cr II	49 55 177	2961.689 2961.70 2961.72	19 UV UV
2958.77	2	Ti I		2958.770	58	2961.90	1				
						2962.12	4	Fe I	[57]	2962.108	7

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2962.16	2					2966.05	5	Cr II	94	2966.03	UV
2962.29	1					2966.20	5	Fe I		2966.193	43
2962.40	4					2966.26	5	Fe I	118	2966.264	7
2962.56	3	Fe I		2962.585	29	2966.91	9W	Fe I	1	2966.898	7
2962.66	3	Zr II	9	2962.69	UV	2967.22	5d	Cr I Ti I	1 1	2967.214 2967.218	37 58
2962.77	2	Vd I	1	2962.784	UV	2967.53	1				
2963.07	2					2967.64	5	Cr I	11	2967.64	UV
2963.27	1	Mn I?	4	2963.250	UV	2968.07	3	-OH	(1-0)	2968.073	8
2963.48	2	Cr II	176	2963.46	UV	2968.22	2w	Ti I	[29]	2968.226	58
2963.54	4	Fe I		2963.518	29	2968.37	5w	Vd II	[28]	2968.373	MT
2963.62	3	Mn I-	3	2963.606	UV	2968.48	5	Fe I	135	2968.477	7
2963.67	4	-Fe I	173	2963.700	43	2968.55	2				
2963.81	2	Fe I	[316]	2963.829	43	2968.69	} 4	Cr II	176	2968.68	UV
2964.03	2					2968.73		Fe II	253	2968.738	UV
2964.12	4	Fe II	252	2964.131	UV	2968.96	3	Zr II	10	2968.95	UV
2964.20	4	Fe I		2964.196	29	2969.07	2	Fe I?		2969.09	51
2964.50	3	Fe I?		2964.489	43	2969.18	4	Ni I	74	2969.190	UV
2964.64	6d	Fe II-	78	2964.629	UV	2969.36	6	Fe I	[11]	2969.360	7
2964.85	4h	C I	1	2964.840	37	2969.48	6	Fe I	[30]	2969.474	7
2965.04	6	Fe II	78	2965.036	UV	2969.63	3	Fe II Zr II	9	2969.623 2969.63	10 UV
2965.26	7	Fe I	1	2965.254	7	2969.94	5	Fe II	277	2969.934	UV
2965.39	4	Fe II	251	2965.395	UV	2970.12	8	Fe I Fe I	1 [11]	2970.100 2970.118	7 7
2965.51	1					2970.35	5d	Si I Ti I	[1] [29]	2970.355 2970.372	37 58
2965.72	3	Ti I	27	2965.686	58	2970.52	6	Fe II	60	2970.510	UV
2965.81	5	Fe I	147	2965.806	7						
2965.88	4										

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2970.68	4	Fe II	276	2970.682	UV	2975.48	5	Cr I	11	2975.478	UV
2970.90	3					2975.66	4h	Vd II Fe I	[28]	2975.650 2975.655	MT 29
2970.95	2	Fe II		2970.947	10	2975.85	3				
2971.11	5	Cr I	11	2971.102	UV	2975.93	5	Fe II	60	2975.938	UV
2971.24	2					2976.14	5	Fe I	131	2976.128	7
2971.50	1					2976.19	4	Vd II	[28]	2976.197	MT
2971.60	2	Fe II	252	2971.616	UV	2976.38	1				
2971.75	3	Fe I		2971.776	29	2976.54	6	Vd II	[28]	2976.517	MT
2971.91	5	Cr II	80	2971.90	UV	2976.72	4	Cr II	55	2976.70	UV
2972.01	3	-Fe II	398	2972.016	UV	2976.90	4	Fe I	172	2976.909	7
2972.28	5	Vd II Fe I	[87] 118	2972.263 2972.280	MT 7	2977.23	1				
2972.42	3					2977.54	3	Vd I	1	2977.550	UV
2972.58	1					2977.66	2				
2973.13	7W	Fe I	1	2973.132	7	2977.81	1	Ti II?		2977.80	UV
2973.23	8W	Fe I	1	2973.235	7	2978.05	4	Fe I Zr II	10	2978.060 2978.07	29 UV
2973.72	4h	Ni I	66	2973.730	UV	2978.19	2				
2973.91	3					2978.27	2				
2974.10	2	Mn I	41	2974.089	UV	2978.46	3				
2974.21	3					2978.56	3	-Mn I	3	2978.566	UV
2974.35	2h					2978.67	3				
2974.64	3					2978.85	3	Fe II	276	2978.850	UV
2974.78	4	Fe I	[335]	2974.780	7	2979.09	3	Fe II Fe II	306 403	2979.096 2979.096	23 23
2974.91	1	Ti I	27	2974.926	58	2979.17	3	Zr II	10	2979.18	UV
2975.02	3					2979.36	6	Fe II	60	2979.349	UV
2975.31	3	Fe I		2975.298	29						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2979.50	1					2983.00	2	Vd II? Vd II?	60 [28]	2983.009 2983.009	UV MT
2979.61	2	OH	(3-2)	2979.615	8	2983.15	2				
2979.74	5	Cr II	80	2979.741	UV	2983.31	4	Ti I	[29]	2983.290	58
2979.87	3	Fe I		2979.867	29	2983.44	4	Ni I	66	2983.426	UV
2979.94	2	OH	(1-0)	2979.929	8	2983.59	8 W	Fe I	[9]	2983.570	7
2980.00	2					2984.13	5	Ni I	[12]	2984.131	MT
2980.21	3					2984.36	3	OH	(3-2)	2984.371	8
2980.41	2h	Ce II?		2980.410	6	2984.57	5	Fe		2984.559	7
2980.53	5	Fe I	[317]	2980.534	7	2984.83	7 W	Fe I Fe II	[29] 78	2984.767 2984.831	7 UV
2980.57	4	Fe I	147	2980.592	43	2985.16	1	Vd II	[218]	2985.184	MT
2980.79	5	Cr I	11	2980.784	UV	2985.33	5	II Cr II Zr I	80 1	2985.325 2985.36	UV UV
2980.96	4	Fe II	253	2980.963	UV	2985.56	6	Fe II	78	2985.545	UV
2981.02	3	Zr II	[24]	2981.02	MT	2985.72	4	Fe I		2985.750	29
2981.21	3w	Vd II	[87]	2981.200	MT	2985.86	5	Cr I	11	2985.849	UV
2981.30	3	Ti II?		2981.27	38	2985.99	5	Cr I	11	2986.01	UV
2981.44	7	Fe I	[11]	2981.445	7	2986.13	4	Cr I	11	2986.13	UV
2981.65	7	Ni I	24	2981.645	UV	2986.30	3w	Fe I		2986.313	51
2981.85	5	Fe I	118	2981.852	UV	2986.46	5	Fe I Cr I	[11] 11	2986.456 2986.466	7 UV
2981.96	3					2986.63	5	Fe II	254	2986.617	UV
2982.04	4	Fe II	335	2982.059	UV	2987.04	3				
2982.25	4	Fe I Fe II	178 277	2982.229 2982.239	7 UV	2987.18	5	Co I	[11]	2987.166	MT
2982.39	3	-OH	(1-0)	2982.403	8	2987.30	6w	Fe I	[30]	2987.290	7
2982.48	3					2987.54	2	Fe II	437	2987.542	UV
2982.63	2					2987.65	7 W	Si I	[1]	2987.645	37
2982.76	3	Vd II	[28]	2982.75	MT						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2987.96	1					2992.42	5	Cr II—	80	2992.42	UV
2988.04	4	IVd II Cr II	[27] 80	2988.027 2988.04	MT UV	2992.59	6	Ni I	[25]	2992.595	MT
2988.18	2	Fe I	[335]	2988.186	43	2993.03	2h				
2988.46	4	Fe I	[56]	2988.472	7	2993.22	2	Fe?		2993.181	7
2988.64	5	Cr I	4	2988.638	UV	2993.29	2				
2988.77	3					2993.40	3h	Fe II	335	2993.366	UV
2988.92	4D	Fe I Sc I Sc II	[11] [34]	2988.882 2988.952 2988.952	7 MT MT	2993.79	4	Fe		2993.793	7
2989.19	5	Cr II	80	2989.18	UV	2994.06	4	Cr I	4	2994.06	UV
2989.39	1	Fe I	85	2989.392	43	2994.18	3				
2989.60	5	Co I Vd II	[13] [28]	2989.590 2989.594	MT MT	2994.43	8W	Fe I	[9]	2994.427	7
2989.70	3	OH	(3—2)	2989.688	8	2994.50	7W	Ni I Fe I	[27] [11]	2994.460 2994.502	MT 7
2990.03	1					2994.75	3	Cr II	80	2994.74	UV
2990.36	6	Fe I	[316]	2990.391	7	2994.94	5	Ca I	[17]	2994.958	45
2990.86	3	Ce II	[72]	2990.872	6	2995.10	4	Cr I	3	2995.094	UV
2991.09	5	Ni I Ni I	1 75	2991.106 2991.106	UV UV	2995.24	3	Fe I		2995.256	29
2991.23	2h	Fe II	252	2991.244	UV	2995.37	2				
2991.39	2h	Zr II	[6]	2991.40	MT	2995.49	3				
2991.63	6	Fe I		2991.632	7	2995.57	2	Fe I OH	[506] (3—2)	2995.565 2995.573	43 8
2991.77	4	Fe		2991.762	7	2995.84	3	Fe I	178	2995.838	UV
2991.88	5	Cr I	11	2991.877	UV	2996.00	3w	Vd II	[27]	2995.999	MT
2992.08	2h					2996.06	2				
2992.17	1h					2996.39	4	Fe I	134	2996.385	7
2992.36	2	OH	(1—0)	2992.349	8	2996.58	4	Cr I	11	2996.571	UV
						2996.72	1	Vd II?	[28]	2996.70	MT
						2996.84	2h				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2997.22	3	Fe II		2997.216	7	3000.93	8 <i>W</i>	Fe I	[9]	3000.948	7
2997.31	4	Fe II Ca I	335 [17]	2997.298 2997.314	UV 45	3001.22	5	Vd II	[27]	3001.203	MT
2997.52	1	Fe I		2997.538	43	3001.42	1	Fe II?		3001.454	10
2997.73	1	Fe II	292	2997.749	UV	3001.66	2	Fe I	[506]	3001.655	7
2997.86	1					3001.77	2 <i>h</i>	Vd II	[141]	3001.754	MT
2997.97	2	Pt I	3	2997.97	UV	3001.92	2	Fe I	178	3001.924	43
2998.01	1	OH	(3-2)	2998.018	8	3002.02	1 <i>h</i>	OH	(3-2)	3002.029	8
2998.15	3					3002.20	2 <i>d</i>	OH? Fe II	(3-2)	3002.183 3002.200	8 10
2998.34	2 <i>h</i>	Fe I		2998.332	43	3002.33	3	Fe II	[98]	3002.330	MT
2998.50	2	Fe II		2998.487	10	3002.41	1	Fe I		3002.439	43
2998.79	4	Cr I	4	2998.783	UV	3002.48	6 <i>W</i>	Ni I	24	3002.484	UV
2998.85	3	Fe II	252	2998.855	UV	3002.61	2	-Mn I	3	3002.616	UV
2998.93	4	Fe II?	437	2998.911	38	3002.66	5 <i>H</i>	Fe II	78	3002.650	UV
2999.00	3	OH-	(3-2)	2998.990	8	3003.03	5	Fe I	[30]	3003.030	7
2999.04	3	Gd II	[12]	2999.045	MT	3003.48	3 <i>w</i>	Vd II	[27]	3003.461	MT
2999.20	4	Fe I		2999.191	7	3003.62	6	Ni I	24	3003.622	UV
2999.32	3	Cr II-	94	2999.30	UV	3003.86	3 <i>d</i>	Fe?		3003.863	7
2999.38	3					3003.89		Fe II ICr II	94	3003.907 3003.92	10 UV
2999.52	7 <i>W</i>	Fe I	[30]	2999.512	7	3004.11	4	Fe I	[199]	3004.116	7
2999.64	3	Ca I	[17]	2999.641	45	3004.26	2	Fe II	276	3004.249	UV
2999.94	2 <i>h</i>	Cr II	137	2999.96	UV	3004.31	1				
3000.06	3	Fe II	276	3000.059	UV	3004.63	4	Fe I	[57]	3004.630	7
3000.34	3					3005.05	5	Cr I	11	3005.06	UV
3000.46	4	Fe I	[56]	3000.451	7	3005.30	5	Fe I	[199]	3005.305	7
3000.56	3 <i>d</i>	Co I	[13]	3000.545	MT						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
3005.47	1	OH Zr I	(3-2) [60]	3005.474 3005.50	8 MT	3009.20	4	Ca I	[17]	3009.205	45
3005.72	3					3009.36	2	OH?	(3-2)	3009.358	8
3005.76	2	Co I	[77]	3005.766	MT	3009.56	6 W	Fe I	[30]	3009.569	7
3005.97	3	Fe I?		3005.951	51	3009.89	1				
3006.17	1h	OH	(3-2)	3006.183	8	3010.01	1	Fe I?		3010.015	51
3006.31	2h	Fe I?		3006.330	51	3010.19	4	Fe II	[181]	3010.220	MT
3006.43	2	Fe		3006.448	7	3010.42	1	Ti I?	[170]	3010.42	MT
3006.54	4	Fe		3006.543	7	3010.62	2d	-Cr II		3010.64	27
3006.60	3	Fe I		3006.598	29	3010.84	1	Cu I	14	3010.838	UV
3006.74	4	Si I	0.01	3006.739	37	3011.16	2	Mn I	[35]	3011.165	4
3006.86	4w	Ca I	[17]	3006.863	45	3011.28	2				
3007.15	6	Fe I	[55]	3007.145	7	3011.37	2	Mn I	[35]	3011.376	4
3007.28	6d	II Fe I Vd II	[11] [27]	3007.282 3007.296	7 MT	3011.48	5	Fe I	[316]	3011.482	MT
3007.47	2h	Ti I		3007.487	MT	3011.63	2				
3007.65	2	Mn I	[35]	3007.650	4	3011.72	3	Zr I	1	3011.73	UV
3007.73	1	Fe I	[262]	3007.75	MT	3011.83	1				
3007.79	1					3011.88	4	Fe I	135	3011.883	29
3008.13	7 W	Fe I	[9]	3008.139	7	3012.00	6 W	Ni I	[41]	3012.004	MT
3008.24	2	Mn I	[35]	3008.258	4	3012.43	5	Fe I		3012.443	7
3008.31	2	Ti II	[85]	3008.322	MT	3012.93	4	Fe I		3012.942	29
3008.44	3d					3013.02	4	Cr I	[26]	3013.033	28
3008.61	3	Vd II	[26]	3008.610	MT	3013.08	4w	Vd II	[26]	3013.102	MT
3008.65	3					3013.32	1	Zr II	[27]	3013.32	MT
3008.79	2	Ce II	[122]	3008.785	6	3013.49	3	Fe I?		3013.515	43
3009.09	5	Fe I	[198]	3009.093	7	3013.59	4	Co I	[10]	3013.592	MT
						3013.71	5w	Cr I	[26]	3013.72	28

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
3014.11	3	Fe I	[458]	3014.106	7	3017.84	3	Fe		3017.856	7
3014.16	4	Fe I	[31]	3014.173	7	3017.94	1	Ni I	74	3017.947	UV
3014.31	2	Fe I		3014.314	43	3018.13	3	Fe I	[199]	3018.136	7
3014.45	1h	Zr I?	[21]	3014.44	MT	3018.24	2	Fe I	[263]	3018.25	MT
3014.65	1	Mn I	[35]	3014.666	4	3018.36	1	Zn I	[5]	3018.352	MT
3014.76	5	Cr I	[27]	3014.756	28	3018.50	5	Cr I	[26]	3018.492	28
3014.83	4	Vd II	[27]	3014.822	MT	3018.81	5	Cr I	[26]	3018.827	28
3014.92	5	Cr I	[27]	3014.932	28	3018.98	6	Fe I	[30]	3018.983	7
3015.18	5	Cr I	[27]	3015.197	28	3019.14	6	Ni I	[11]	3019.143	MT
3015.35	1	Sc I	[10]	3015.364	MT	3019.28	4	Fe I	[199]	3019.290	7
3015.49	3	Cr II	[87]	3015.510	MT	3019.81	1	Fe		3019.804	7
3015.68	1h	Co I	[76]	3015.686	MT	3019.91	3	Mn II		3019.923	19
3015.81	1					3020.00	4	Fe II II Si I	[110] 0.01	3020.001 3020.004	MT 37
3015.92	5	Fe I	[198]	3015.920	7	3020.49	8W	Fe I	[9]	3020.491	7
3015.98	1					3020.63	9W	Fe I	[9]	3020.639	7
3016.19	6	Fe I	[30]	3016.182	7	3021.07	8W	Fe I	[9]	3021.073	7
3016.45	2	Mn I	[35]	3016.454	4	3021.55	6	Cr I	[27]	3021.576	28
3016.53	1					3022.25	2	Fe I		3022.260	43
3016.77	4w	Vd II	[27]	3016.775	MT	3022.34	2	Fe		3022.330	7
3016.85	2					3022.58	3w	Vd II	[26]	3022.57	MT
3017.19	4	ITi II Ce II	[85] [107]	3017.187 3017.195	MT 6	3022.73	3	Mn I	[35]	3022.743	4
3017.26	4	Co I Fe	[78]	3017.254 3017.259	MT 7	3023.06	3				
3017.41	4	Fe		3017.418	7	3023.68	1				
3017.60	7W	Co I Cr I Fe I	[11] [27] [9]	3017.548 3017.591 3017.627	MT 28 7	3023.85	2W	Fe II Vd II	[84] [41]	3023.859 3023.882	MT MT
						3024.03	7W	Fe I	[11]	3024.032	7

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
3024.22	2					3029.10	3				
3024.34	6	Cr I	[26]	3024.359	28	3029.18	5	Cr I	[26]	3029.165	28
3024.68	1	Cr I	[117]	3024.689	28	3029.26	5w	Fe I	[56]	3029.234	7
3024.80	3	Fe		3024.798	7	3029.30	3	Ni I Ni I	[56] 74	3029.293 3029.293	MT UV
3024.98	3w	Vd II	[85]	3024.981	MT	3029.54	1h	Zr I	1	3029.52	UV
3025.28	4	Fe I	[29]	3025.280	7	3029.74	5	Ti II	[85]	3029.730	MT
3025.64	6	Fe I	[198]	3025.638	7	3029.99	3				
3025.86	8W	Fe I	[9]	3025.842	7	3030.16	6	Fe I	[198]	3030.148	7
3026.37	3	Co I	[77]	3026.373	MT	3030.25	6	Cr I	[27]	3030.25	28
3026.46	6W	Fe I	[30]	3026.461	7	3030.61	3	Fe I	[145]	3030.603	7
3026.64	4	Cr II	[95]	3026.64	27	3030.78	1	Sc I Fe I	[10] [459]	3030.769 3030.787	MT 7
3026.83	2	Cr II	[41]	3026.86	27	3030.85	1	OH?	(3-2)	3030.842	8
3026.96	2					3030.94	3d	Zr II- Fe I	[6]	3030.91 3030.963	MT 43
3027.00	2					3031.04	3	Mn II		3031.038	19
3027.02	2	Vd II Gd II	[85] [12]	3027.600 3027.602	MT MT	3031.23	6	Fe I	[198]	3031.214	7
3027.66	2					3031.35	5	Cr I	[27]	3031.346	28
3027.72	2					3031.49	2	Cr I	[117]	3031.498	28
3028.05	4	Vd II Zr II	[85] [76]	3028.042 3028.05	MT MT	3031.63	6	Fe I	[30]	3031.634	7
3028.13	4	Cr II	[87]	3028.12	27	3031.72	5	Fe?		3031.718	7
3028.28	1					3031.88	6	Ni I	[11]	3031.870	MT
3028.62	2					3032.18	1				
3028.70	2	Fe		3028.700	7	3032.47	2	Ni II	[3]	3032.458	52
3028.88	3					3032.86	1	Gd II	[12]	3032.845	MT
3029.04	3	Mn II Mn II	[10]	3029.043 3029.043	19 19	3032.93	4	Cr II	[15]	3032.94	27

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
3033.10	4	Fe I	131	3033.100	7	3037.68	2				
3033.43	4 _w	Vd II	[123]	3033.445	MT	3037.77	4	Fe I	[31]	3037.779	7
		Fe II	[181]	3033.445	MT	3037.92	6	Ni I	[25]	3037.935	MT
3033.59	2 _h	Mn II	[21]	3033.574	19	3038.09	3	Mn II		3038.092	19
		Mn II		3033.574	19						
3033.81	4	Vd II	[34]	3033.821	MT	3038.30	4	Co I		3038.302	50
								Fe I		3038.314	7
3034.06	1	Gd II	[12]	3034.051	MT	3038.51	3	Mn II		3038.507	19
3034.19	5	Cr I	[26]	3034.191	28	3038.72	3	Ti II	[85]	3038.706	MT
3034.42	4	Co I	[12]	3034.432	MT	3038.77	3	Fe II	[84]	3038.777	MT
3034.48	5	Fe I	[57]	3034.484	7	3039.00	2				
3034.52	4	Cr II	94	3034.54	UV	3039.07	4	Ge I	[2]	3039.067	25
3034.81	1	Mn II	[21]	3034.807	19	3039.31	4	Fe I	[199]	3039.318	7
3034.98	2	Cr II	137	3034.99	UV	3039.56	1	Mn II	[10]	3039.550	19
3035.23	2	Fe I	[506]	3035.25	MT			Co I	[52]	3039.563	MT
3035.36	3	Mn II		3035.350	19	3039.60	4 _w				
3035.74	5	Fe I—		3035.737	7	3039.77	4	Cr I	[26]	3039.77	28
3035.89	1					3040.43	6	Fe I	[30]	3040.427	7
3036.12	2 _h	Cu I	17	3036.101	UV	3040.50	1				
3036.25	1					3040.59	4	Mn I	[34]	3040.600	4
3036.40	2	Zr II	[25]	3036.39	MT	3040.77	2				
3036.50	1	Zr II	[24]	3036.50	MT	3040.84	4	Cr I	[27]	3040.837	28
3036.77	2 _h	Ti II	[78]	3036.784	MT	3040.94	5	Cr II	[65]	3040.91	27
3036.98	2	Fe II	[181]	3036.986	MT	3041.02	2				
3037.06	5	Cr I	[27]	3037.049	28	3041.23	1	Mn I	[34]	3041.220	4
3037.22	3					3041.41	2 _h	Vd II	[40]	3041.42	MT
3037.40	8 _W	Fe I	[9]	3037.389	7	3041.51	1				
3037.54	3					3041.65	6	Fe I	[56]	3041.637	7

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
3041.74	6	Cr II Fe I	[95] [30]	3041.73 3041.738	27 7	3045.79	2	Mn I	[34]	3045.804	4
3041.91	3					3046.04	2	Fe II?		3046.064	10
3042.02	6	Fe I	[30]	3042.019	7	3046.28	1	Mn II	[10]	3046.271	19
3042.26	3	Vd II	[40]	3042.27	MT	3046.49	2				
3042.50	4	Co I	[10]	3042.481	MT	3046.68	5	Ti II	[47]	3046.685	MT
3042.67	6	Fe I	[30]	3042.664	7	3046.81	3	Fe I	[315]	3046.819	MT
3042.73	3	Mn I	[34]	3042.734	4	3046.93	4	Fe I	[198]	3046.926	7
3042.84	4	Fe		3042.843	7	3047.04	4	Mn I Fe I	[34] [457]	3047.032 3047.050	4 7
3043.13	3	Vd I Mn II Mn I	[17] [21] [34]	3043.124 3043.128 3043.139	MT 19 4	3047.22	3	Fe I	[382a]	3047.201	MT
3043.35	3	Mn I	[34]	3043.355	4	3047.34	2				
3043.54	3	Vd II Vd I	[40] [17]	3043.54 3043.555	MT MT	3047.60	8 W	Fe I	[9]	3047.604	7
3043.78	1	Mn I	[34]	3043.768	4	3047.76	4	Cr II	[15]	3047.77	27
3043.85	4	Ti II	[78]	3043.851	MT	3048.00	1				
3044.00	5	Co I	[11]	3044.004	MT	3048.09	1	Co I	[77]	3048.108	MT
3044.12	2					3048.22	3	Vd II	[123]	3048.214	MT
3044.23	2 w	Cr II	[154]	3044.23	27	3048.36	1				
3044.57	4	Mn I	[15]	3044.566	4	3048.45	5	Fe I		3048.452	7
3044.84	3	Fe II	[98]	3044.843	MT	3048.76	3	Ti II	[78]	3048.766	MT
3044.94	2	Vd I	[17]	3044.936	MT	3048.89	4	Mn I Co I Vd II	[34] [11] [40]	3048.860 3048.888 3048.891	4 MT MT
3045.03	5	Ni I	[12]	3045.006	MT	3049.01	2 h	Fe II Mn II	[181] [21]	3049.011 3049.025	MT 19
3045.09	5	Fe I	[29]	3045.078	7	3049.13	1 h				
3045.58	4	Fe I Mn I	[198] [34]	3045.587 3045.590	7 4	3049.35	4	Fe I		3049.354	7
3045.72	3	Sc II	[37]	3045.714	MT	3049.54	3	Fe I		3049.564	29
						3050.08	3 w	Al I	[7]	3050.073	14

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
3050.13	4	Cr II	[65]	3050.14	27	3054.84	3	Zr II	[76]	3054.84	MT
3050.24	1 _h					3054.94	3	Fe I	[263]	3054.949	MT
3050.40	1 _w	Vd I?	[74]	3050.400	MT	3055.13	3				
3050.50	1 _h	Co I	[77]	3050.496	MT	3055.22	3	Ce II	[201]	3055.238	6
3050.66	4	Mn II	[21]	3050.654	19	3055.27	5	Fe I	[55]	3055.262	7
3050.82	7 _W	Ni I	[25]	3050.819	MT	3055.34	3	Fe II	[181]	3055.368	MT
3050.93	4	Co I	[51]	3050.932	MT	3055.45	2 _h	Cr II	94	3055.44	UV
3051.03	3					3055.70	4	Fe I		3055.710	7
3051.43	2 _h	Mn II		3051.426	19	3056.10	2				
3052.13	1					3056.24	4	Fe I		3056.242	7
3052.21	1	Cr I	[164]	3052.218	28	3056.33	4	Vd I	[17]	3056.334	MT
3052.27	1	Fe I?		3052.264	43	3056.58	3				
3052.49	2					3056.74	5	Ti II	[47]	3056.740	MT
3052.59	1					3056.77	4	Ce II Fe II	[121] [109]	3056.775 3056.802	6 MT
3052.79	1 _h	Fe I	[262]	3052.78	MT	3057.02	2				
3052.92	1	Sc II	[37]	3052.929	MT	3057.16	4	Al I	[7]	3057.144	14
3053.06	5	Fe I	131	3053.067	7	3057.46	2 _W	Fe I	[28]	3057.446	7
3053.42	5 _D	Vd II Fe I Fe I	[34] [398] [31]	3053.39 3053.429 3053.455	MT 7 7	3057.65	7	Ni I	24	3057.638	UV
3053.67	3	Vd I Cr II	[17] [64]	3053.65 3053.65	MT 27	3057.80	4	Fe I	[29]	3057.789	7
3053.76	3	Fe I		3053.781	29	3057.87	1	Cr II	[65]	3057.86	27
3053.88	5	Cr I Vd II	[26] [40]	3053.87 3053.894	28 MT	3057.96	3				
3054.33	6 _w	Ni I Mn I	[25] [15]	3054.316 3054.362	MT 4	3058.08	5	Ti II	[47]	3058.090	MT
3054.70	3 _h	Al I Co I	[7] [13]	3054.679 3054.724	14 MT	3058.36	4	Cr II?	[48]	3058.36	27
						3058.50	4	Fe I		3058.493	7
						3058.71	3 _h				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
3058.96	4					3062.69	1h	Vd II	[34]	3062.702	MT
3059.11	8W	Fe I	[9]	3059.086	7	3062.83	2				
3059.37	4	Cr II	[15]	3059.38	27	3062.87	4	Fe I	[456]	3062.872	MT
3059.51	5	Cr II	[15]	3059.53	27	3063.18	3w	Fe I—	[102]	3063.149	MT
		Cr II	[15]	3059.53	27	3063.24	4	Vd II	[123]	3063.247	MT
3059.74	5	Ti II	[5]	3059.741	MT	3063.49	4	Ti II	[47]	3063.502	MT
		Ti II	[47]	3059.741	MT	3063.56	4	OH	(0—0)	3063.565	8
3059.94	1	Al I	[7]	3059.924	14	3063.73	5	OH	(0—0)	3063.725	8
3060.03	3w	Fe II	[109]	3060.023	MT	3063.79	1	Fe II		3063.814	23
		Co I	[77]	3060.048	MT	3063.93	5	II Fe I	132	3063.931	7
3060.25	1							Ni II	[3]	3063.942	52
3060.34	2	Fe		3060.359	7	3064.02	4	Fe		3064.018	7
3060.45	3	Vd I	[17]	3060.460	MT	3064.19	5	OH	(0—0)	3064.189	8
3060.53	3	Fe I	[457]	3060.538	7	3064.23	4	OH	(0—0)	3064.236	8
3060.62	4	Fe		3060.621	7	3064.37	3	Co I	[13]	3064.370	MT
3060.77	4	Fe		3060.777	7	3064.62	6	Ni I	24	3064.619	UV
3061.00	5	Fe I	[55]	3060.983	7	3064.68	4	Pt I	1	3064.69	UV
3061.14	1					3064.83	3				
3061.38	1h					3064.95	4	OH	(0—0)	3064.950	8
3061.57	2	Cr II	[41]	3061.58	27	3065.06	4w	Cr I	[184]	3065.065	28
3061.65	1	Cr I	[55]	3061.64	28			OH	(0—0)	3065.095	8
3061.82	5	Co I	[11]	3061.822	MT			Sc II	[37]	3065.106	MT
3061.98	1	Fe I?		3061.948	51	3065.32	4	Fe II	[97]	3065.315	MT
		Co I?	[52]	3061.983	MT	3065.62	1	Vd II	[112]	3065.61	MT
3062.12	3	Mn I	[15]	3062.120	4	3066.00	5	OH	(0—0)	3065.976	8
3062.24	5D	Co I	[12]	3062.199	MT			Mn I	[15]	3066.022	4
		Fe II	[108]	3062.234	MT	3066.15	4	Al I	[7]	3066.145	14
3062.50	1	Fe		3062.491	7	3066.23	6	Ti II	[5]	3066.220	MT

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
3066.35	6 <i>W</i>	!Ti II Vd I	[5] [17]	3066.354 3066.375	MT MT	3067.93	5	!OH !OH Fe I	(0-0) (0-0) [315a]	3067.929 3067.929 3067.948	8 8 7
3066.49	6	Fe I Ti II	[313] [47]	3066.479 3066.514	7 MT	3068.18	5	Fe I	[55]	3068.173	7
3066.69	2	Fe I	[456]	3066.69	MT	3068.26	4	OH	(0-0)	3068.277	8
3066.82	2					3068.47	3				
3067.03	5	Fe I		3066.999	7	3068.61	4	OH	(0-0)	3068.608	8
3067.15	6 <i>w</i>	Vd II Fe I Cr II Cr II	[34] [56] [15] [15]	3067.104 3067.118 3067.18 3067.18	MT 7 27 27	3068.72	4	OH	(0-0)	3068.704	8
3067.25	7 <i>W</i>	Fe I	[28]	3067.244	7	3068.79	2	Fe II	[122]	3068.757	MT
3067.66	4	OH	(0-0)	3067.661	8	3068.94	2	Fe I	[53]	3068.927	MT
3067.77	3	OH	(0-0)	3067.775	8	3069.18	4	OH	(0-0)	3069.177	8
						3069.34	3	Fe		3069.330	7
						3069.44	4	Fe I		3069.443	7

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